Approaches to Environmental Education in Schools

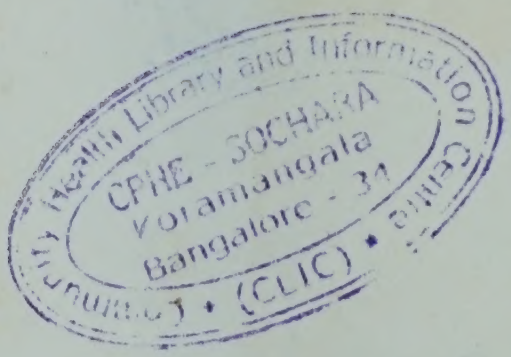
Some Working Papers

Centre for Environment Education
Nehru Foundation for Development
Ahmedabad 380 054, India

Approaches to Environmental Education in Schools

Some Working Papers

Centre for Environment Education
Nehru Foundation for Development
Thaltej Tekra, Ahmedabad 380 054, India



Authors

Amrita Shodhan, Abdul Razak, K. Shivram, E.K. Nareshwar, Poonam Kathuria, R. Suresh, Ramesh Uttam and Vivek Khadpekar are with the Centre for Environment Education.

Dr. C.J. Sanchorawala, Dr. Mala Chinoy and Ramesh Kothari are from Vikram A. Sarabhai Community Science Centre.

Bandana Sen is from the American Embassy School, New Delhi.

Illustrations are by Ramesh Kothari and E.K. Nareshwar.

Photographs are by Manoj Dholakia and Ramesh Uttam.

Contents

Preface

In the last few decades the process of instruction has undergone considerable change. Research in learning and the development and trial of a variety of educational approaches in behavioural science have helped improve the methods of teaching. They have contributed to the teacher's repertoire of teaching methods. A shift has been advocated from treating children as response reproducers to treating them as response producers and information seekers. Instruction is no longer equated with teachers' talk-and-chalk method nor considered a directive act.

The National Policy on Education, 1986, while focusing on the role of schools and teachers as change agents, has stressed the need for equipping children with better knowledge, attitudes, values and skills to face the world around us and to adjust to the changing societal conditions. Concerted efforts have been made at the national and state levels to subject the entire school curriculum to scientific scrutiny and effect necessary changes in the perspectives, content and methodologies of school education. The policy recommends to teachers activity-oriented and participatory methods of instruction rather than teacher dominated instruction. Many educational institutes have been asked to participate in preparing educational modules and teachers' guide books keeping in view the thrust areas focused in the policy. It is encouraging that environmental education is an important thrust area at the school level.

The Centre for Environment Education (CEE) in collaboration among others with Vikram A. Sarabhai Community Science Centre (VASCSC) developed, during March, 1986, a handbook of environmental education activities for primary school children for the National Council of Educational Research and Training (NCERT), New Delhi. Titled 'Joy of Learning', the handbook is a child-centred and activity-oriented book that suggests a wide range of teaching methods for environmental education. Some of these are field observations, crafts, games, experimentation and performing arts. What is desired is that teachers try out these activities in their regular classroom teaching and make learning a joyful experience.

This volume presents a set of working papers on the various methods described in 'Joy of Learning'. The methods highlighted in this volume, as pure instructional techniques, could be made use of for teaching other school subjects as well. These papers, written by senior staff members of CEE and VASCSC, formed the basis of the

technical sessions held during the three-day coordination workshop for Nationwide Teacher Training Programme on Environmental Education in Schools at Gandhinagar, Gujarat, during October 20-22, 1986. Though the volume is not comprehensive in its coverage of instructional methods, it gives an indication of a variety of methods that can be effectively used at the school level. The methods reflect the experience of trials of these techniques at CEE and VASCSC in school and teacher training programmes.

I hope the papers presented in this volume would be useful to you and others in the field.

We would be happy to receive feedback on the techniques. after you have tried them in your teaching.

Dr. M.J. Ravindranath
Co-ordinator
School Programmes
Centre for Environment Education

Camping and Excursions

Lavkumar Khachar

Camping and taking children out for excursions are not new and schools have been regularly arranging such outdoor activities. Unfortunately, the possibilities of camping and of short excursions have not been utilised fully by a majority of teachers and the general tendency has been to organise such programmes during holidays and long vacations. This is unfortunate as a great deal of the syllabus can be very effectively taught during excursions and short outings in the neighbourhood. If a teacher was to attempt to do this, much of the reluctance of principals to permit classes to go out during school term would be removed. Parents too are rather reluctant to agree to let their children join school trips on the specious plea that they will be missing academics. If, however, the school authorities overcome their reticence in permitting camping and outing programmes as part of the teaching process, parental objections are very minimal and not of much significance. The conducting of specific teaching activities out in the open depends on the teacher and his own enthusiasm. Developing a teaching programme outside the classroom has many problems which most teachers are not quite willing to face. We shall discuss the problems first.

Children tend to become very boisterous when outside the confines of the classroom and there are so many things around them that there is a real difficulty in making them concentrate on very specific issues. It is here that the personality of the teacher becomes a determining factor. The other problems most teachers face is to concentrate on a few specifics and to direct the children's attention to the topic being discussed. Some planning, and of course experience, can overcome these difficulties. The teacher must be comfortable in the outdoor situations before he can become effective.

Organising outings calls for a great deal of pre-planning which again most teachers find an additional burden. Fortunately, certain agencies have started organising nature camps, and schools have been sending groups to these camps. That these camping experiences have not become as useful as they may well become is because teachers by and large have themselves not accepted the value of the camps and the opportunities they afford them. Schools have yet to accept the suggestion that outings and camps be organised on a class basis and the tendency is of a teacher or two being sent out with

a heterogeneous group of children. Schools should start considering sending children of specific standards to particular camps. In this way, it would be possible for all the children in a school to attend at least one camp every year of their schooling and have a chance to participate in a wide variety of programmes.

Almost every discipline can usefully utilise an outdoor situation. Geography is a subject which can be advantageously taught outside the class room. Marine situations are excellent to make children understand the phases of the moon and how they affect tides. Mountain country is best for observing erosion of soil and weathering of rocks caused by various natural agencies and learning about the movement of winds and the influence topography has on the weather and climate of an area.

Broad concepts of the environment can be put across to children most effectively, as for example the importance of vegetation in holding soil, and in some cases, the formation of clouds over wooded hill slopes which provide very strong evidence of the valuable role of forests in increasing precipitation in an area. From a mountain top, the formation of clouds is something exciting to observe, and during the observations very useful discussions can be developed. Solid profiles, and various types of rock formations are best shown while in the field. Children very easily understand how fossils can be formed when they see sedimentation taking place. In fact, there are locations where it is possible to see fossil-bearing rocks.

There can be nothing more exciting than to have children making observations on marine life on a coral reef, or observing the rich life to be found in a fresh water pond. Even the most casual observation can teach more than a lot of discussions inside a classroom. True, further follow up work has to be done in a classroom or a library.

A teacher who has planned well before going out, can make an excursion, or a few days in a camp, far more educative than is possible in the traditional setting of a school. Learning about plant communities cannot be very efficiently done unless children actually see these for themselves from some vantage point. Such observations can lead to discussions about why certain types of vegetation grow in one part of the country and a different type in another.

Above all, only when a child is out of doors can it appreciate that human life is influenced and thus shaped by the natural world.

Neighbourhood Field Trips

Vivek Khadpekar, Amrita Shodhan, Abdul Razak

Introduction

During a field observations session you would go to a particular environment to observe and understand it. You may choose any place — the room you are sitting in, the garden nearby, a place of historical importance, a settlement area, a factory, a pond, a forest, a footpath, etc. You would concentrate on some aspects of the environment so that the observations are focused and concrete. The understanding that results from the observations is a personal and concrete one in contrast to one which is learnt at second hand from a book or from a teacher. It is not an objective or quantitative understanding but a qualitative and subjective one.

A field observations session is a learning experience which can lend itself to a variety of other experiences. Thus whatever the students understand or learn from the session can be extended to other projects (technical sessions) such as action programmes, news gathering, and the making of a resource centre.

Areas that may be observed

What follow are some suggestions for places in which to conduct the field observations.

The school room or the school compound. These can be interesting places to observe many or all of the various features we have suggested below.

Any neighbourhood like the neighbourhood of the school, the neighbourhood of the home and the different residential areas in a village.

A public place such as a busy street, a footpath, a railway station, or bus stand, a place of historical importance such as a religious establishment, a monument, an archaeological site, an ancient tank etc.

A factory or an industrial area. Example — a large production unit, a small handicrafts unit, a complex of factories.

The revenue land surrounding the village — the various agricultural fields, the various water sources etc.

A natural spot — a pond, a tree, a garden, a mountain, a forest, a desert etc.

Things to observe

There are some points on which the students may focus their observations. Any of the following may be undertaken at any place and at any time, though you might feel that some particular observations are better suited to particular areas or places. You may combine some features suggested. For example while observing village revenue areas you may combine numbers 9 and 10 for a really fruitful observation; in the class room you may combine numbers 1 and 8 and so on. You may add new features for observation whenever you feel that your subject or the area you are visiting calls for it.

1. The animals, the insects, the plants, the trees and the connections between the living creatures and the surrounding objects — either manmade or natural ones. For example, if you are near a tree you could see birds eating the fruits of the tree, or if you are in the class you might see ants carrying away wasted or dropped food.

2. The rocks, stones, flowing water, soil and the effects of natural forces like water and wind (e.g. the effects of erosion by water during the rains). You may even observe the formation of clouds if you are in a mountainous area.

3. The smells, sounds and the sights of any area whether familiar or unfamiliar. If it is done in a familiar situation it will show how one is not really observing one's environment.

4. The buildings, the materials with which they are made, the type of buildings, their appearance, the decoration (e.g. the sculpture on an old building), the things represented in the decoration (e.g. nature, geometric shapes), the orientation of the buildings to particular directions, the symbolic meanings given to any aspect of the building (if any) etc.

5. The people. The concentration of communities in particular areas, their dress and other characteristics, the interactions between them, their style of talking etc.

6. The activities going on in the area. The various things people are doing, the uses of different spaces, the inter-relationships between the various uses and the various activities etc.

7. The changes that have occurred in the place, in its use or in its general appearance.

8. The kinds of waste produced and disposed of, the manner of disposal, the effects of such disposal etc.

9. The kind of land and the infrastructural facilities available such as the water sources, the sewage system, the seeds, fertilisers and agricultural implements.

10. The correlation between the ownership of land and access to resources like irrigation with economic, social and political status.

Possible ways to observe

The activities suggested here are complementary and you may do some of them or all of them according to the needs and interests of the children and the constraints of the situation. They can be done during any of the field trips you undertake. You could add new ones also.

- Noting things on paper
- Sketching the observations
- Talking to people and getting information which is relevant to the observation topic
- Collection of items of news/objects for the resource centre

You may conduct the following exercise:

"Sounds Smells and Surfaces"

Divide the children into pairs. Blindfold one of the pair. Ask them to walk in the area without talking and observe what is there in the area. One child will concentrate on the visual details and the other will concentrate on the sounds, smells, and the kind of surfaces walked over. Then you may ask the children to settle down in a circle and discuss what they saw, smelt and heard.

Preparation for the field trip

Duration: The actual observation time should not be more than one hour. The attention of the child may wander after that. But you may extend the time by including activities like sketching, and the exercise described above. You may decide the time span convenient to you.

Grouping: You may make groups of three to five children, and ask each group to observe one particular aspect of the environment which you decide upon. This will ensure that the observations are focused and perceptive. If you identify too many things for them to

observe the quality of observation will decline. Or you may divide the field into different areas and allot the various areas to the various groups and ask them to observe one particular identified feature.

In the case of the factory visit you may have to ask the permission of the factory before visiting the place.

The observations on the field trip will lead to much discussion among the children and you may encourage it so that there may emerge ideas for action programmes, as well as for other projects.

Resource Centre

Bandana Sen

Children are active people and continually seek to learn and discover more about their world and how to function within and without it. Recently conducted research shows that children's basic attitude towards life, experiences and learning are established in their first few years. What better gift can we, as teachers, parents and resource persons give to children than providing an atmosphere where they can explore and learn on their own. I would emphasise 'on their own', since no learning can really take place in a dependent atmosphere. We need to create an environment which is attractive and appealing to children and people of all age groups. Real learning is not possible unless children do it themselves.

The library, or resource centre, is no longer an extension of the classroom but vice versa. The concept of a library as a store-house of books and the librarian as the keeper of these books is long since dead. Today the library is a resource centre, alive, active and dynamic. The librarian is the resource person in the resource centre and its facilities. He acts as a catalyst in the child's learning process.

The resource centre should cater to the needs of all students from nursery to college level. It should have attractive furniture and accessories scaled down to their level. The place should be decorated with murals and drawings made by the users themselves. The room should be bright and well-lit, the children should feel at home in it. Fold art, masks, stuffed toys etc. could be made available so that young children can pick them up before settling down in their seats.

For college, high and middle schools, the atmosphere should be more formal. There should be plenty of books to be used as secondary resources. Since things done in the resource centre are their own activities, the place becomes a living organism.

Various kinds of materials can be kept in the resource centre — books, records, kits, film strips, slides, computer software, maps, globes, hand-on learning kits, board games etc.

In case the environment is of a one-room school, even then certain things are possible. A corner could be cleared and the children could make designs with coal, rice powder, haldi or any other natural dyes available.

Getting the children to come to the resource centre is not the end of it. Various activities can be organized by the centre, such as on-the-spot poetry writing competitions, nature day, chess competitions and book writing competitions. Also book fairs in which the child participates with his family can be organised.

The idea is to make the resource centre the focal point of the school and not just any part of it.

Biological Collection

E.K. Nareshwar

Why specimen collection

- Allows longer time for study

- For zoo/aquarium

A field trip to a beach or different types of coastal areas, such as a sandy or a rock shore, could form a part of environmental education for school children. One can find sea-shells, coral remains, seaweeds and exo-skeletons of marine animals like crabs, lobsters, etc. A walk along the beach could lead to interesting questions from children based on their observations. Such discussions could help conduct integrated science lessons, involving biology, geography, chemistry, physics, geology and even arts. Children should be asked to avoid disturbing any of the live animals inhabiting the shores.

Children could be encouraged to observe the aquatic plants such as hydrilla, vallisneria. bladderworts etc. If necessary one of the plants could be removed by the teacher/instructor for closer observations. But as far as possible doing any kind of damage to the basic balance of nature should be avoided.

During terrestrial collection keep a good watch around. Look for movements in the undergrowth. Comb lead litters carefully. Upturn bricks and stones where most of the tiny arthropods, worms, lice, bugs and some kinds of beetles, can be seen. But these may be hiding places for scorpions too. So this activity should be done with care. If possible a stick should be used to upturn stones or gently comb the leaf litter.

For insect collection, encourage the collection of the dead ones only for close observation, unless a museum-collection is required. In fact, insects are best observed live in nature. A magnifying glass could be used for closer observation.

How to make a collection net

(a) Choose a length of stick in the shape of "Y"
(b) Tie a handkerchief along its limbs with strings.

The net can come in handy for closer observation of fish, molluscs, tadpoles etc.

Herbarium collection

One could make a herbarium collection using plants that have withered out. Indiscriminate botanical collection is against the laws of conservation. Nevertheless one can collect botanical specimens that are found easily, e.g. fallen leaves, grass and herbarium plants.

How to make a herbarium

a) Use old newspapers to make a portfolio. The entire newspaper could be used.
b) Place the collection and stick with cellotape
c) Cover each page with an interleaf
d) Keep pressed for two or three days.

Collection of Natural Inanimate Objects

Getting to understand objects inanimate like rocks, stones, soil etc. is as essential to learning as understanding animate objects. Though lifeless, these objects have their own beauty. A collection of such things could prove valuable for interpreting the environment and its ceaseless changes.

Rocks and soil in one place might be totally different from those in another location. This provides a great variety of rock and soil type for collection. One can do such collection during an excursion, holiday outing or while camping.

The collector should be observant and take note of the properties of the sample, such as its colour, form, hardness, optical properties, texture etc. He should record from where a particular object was found. For classifying a collection, books on geology could be consulted. For additional information on the objects the Geological Survey of India could be contacted.

If the rocks are small enough, they could be neatly packed in matchboxes. The same can be done with soil samples also.

A rocky terrain is the ideal place for rock and crystal collection. Sometimes one might come across precious and semi-precious stones like ruby or quartz. River beds are also suitable places for rock collection. Many smoothened pebbles belonging to various places through which the river flows can be obtained from here.

Sometimes it is interesting to collect dead wood or drift wood from slow, shallow streams. Drift wood comes in various sizes and shapes. Some may resemble familiar objects like animal and even human figures. By carefully whittling away portions of the wood the

resemblance could be made more striking. A collection of these things becomes immensely rewarding.

Requirements on the field

1. Note pad
2. Sketch pens/pencils/pen etc.
3. An iron rod or a firm stick with one end curved or hooked
4. Glass bottles/jars with perforated cap
5. Polythene bags
6. Forceps (large)
7. Surgical gloves
8. Glass slides
9. String, cloth, cotton, etc.
10. Buckets
11. Magnifying glass

How to make a simple microscope

- Take a glass slide and place a drop of water on it. See to it that no air bubbles are present in the drop.

- Mount the specimen that needs to be observed (e.g. bark tissue, leaf, insect, etc.) on another slide.

- Place the slide containing the waterdrop directly over the mounted specimen and observe it through the drop. The drop acts as a plano-convex lens.

- By placing another drop of water axially below the first drop, a bi-convex lens effect can be obtained. Try this too.

Preservation techniques

1. Brine method

Soft bodied animals like hydra, snail, earthworm, crab, fish etc. can be preserved in brine.

How to make brine

To a bucket full of water add common salt till there is over saturation i.e. keep adding salt till you get a precipitate of salt. This solution could be used to preserve specimens.

2. Formaline method

a) To one part of formaline add three parts of water carefully and slowly. Stir gently.

b) Fill three-fourths of the glass bottle with this formaline solution.
c) Firmly attach the specimen to a glass plate. (The specimen and the glass plate should be able to pass through the mouth of the bottle). The glass plate anchors the specimen or else it would float to the surface. Immerse the specimen into the solution.

Note: Formaline is highly inflammable and caustic. Take care while mixing.

Taking animal track prints

During collection trips keep a close watch on the ground for pug-marks or animal foot-prints.

Foot-prints are more distinguishable where the mud is soft, for example, near a water hole. Impressions of such foot-prints could be taken in plaster-of-paris.

Take plaster-of-paris powder. Add water till it is consistent. Pour the mixture into the cavity of the impression. Wait till the plaster sets. Gently pry the cast off the ground.

A mould could be made from the cast. Apply oil (hair oil) on to the cast impression. Now pour the plaster over it and let it set. Remove the mould by gently tapping the sides.

Plaster casts of shells, tiny burrows etc. can be taken in this manner.

Dos and Donts

1. Take care not to disturb the habitat
2. Replace deadwood, stone, rocks etc. after turning over
3. Do not pick too many stones or shells, as they are required by the soil as nutrient for plant growth
4. Keep a safe distance from venomous species
5. You may collect specimens that propagate abundantly
6. The collection of specimens should be from both fauna and flora
7. The collection should be for an educational purpose only, and limited
8. Specimens which are easy to handle should be collected
9. Collection of live specimens should be avoided
10. Live specimens should be used only for demonstrations
11. We must remember that wanton collection could upset the biota of the environment.

Observing the World Around Us

Dr. C.J. Sanchorawala

All living systems including man depend on their ability to observe. The observations come to us through our senses. The senses of man have their limitations but by the inventions of tools and techniques these limitations have been overcome to a large extent. With the help of these tools, man has extended the range of his senses. For example, man can see things not visible to the naked eye through a microscope or a telescope. Man has also learned to state his observations in quantitative terms so that these could be reproduced or checked by others. With the help of tools, he is able to investigate microscopic and astronomic phenomena which occur either on a very small or a very large scale of time and length.

In every day life, we estimate length, time, mass etc. of many items. This estimation is based on our experiences and judgement and plays an essential part in all human activities including science. After estimating we can check our degree of correctness by measuring with a tool.

We know very well that if we keep one hand in cold water and another in hot water for some time and then place them simultaneously in warm water, the hand which was put in cold water will feel the sensation of cold. There are several such examples which show that the senses do not always provide reliable information. The senses become tired or adapted to continuous stimulation over a period of time. For example, after eating a sweet if we drink a cup of tea it tastes less sweet. Similarly after carrying a school bag to school and putting it on the desk the student feels lighter. If we stare at a black picture for sometime and then suddenly look at a plain white paper we see a bright image of the black picture for some time. Time seems to pass very rapidly when we are happy or involved in any activity we like, but, when we are in tension, time does not seem to pass.

There are several optical illusions which illustrate the errors of observations. In the following illustrations, are the lengths of line A and B equal ? Measure the lines and check your answer.

A few illusions that we have seen are thought to be due to the way in which the brain organises information received from the eye. We therefore must not totally depend on our senses but derive some

methods of observation which should be objective as well as reproducable. Quantitative observations carried out with the help of some standard units are referred to as measurement.

If measurements have to be reliable, we must have standard units acceptable to every one. Usually the measurement is expressed as a multiple or fraction of standard units. Hence once an unit is accepted then measurement simply becomes a matter of counting.

Earlier, different countries and states had their own arbitrary systems of measurement. This created a good amount of confusion in trade between them.

Volume : How much air we breathe in a day

Materials required: Cubes of volume 1 cubic cm made of metal or wood; Measuring cylinder (100 c.c.); Glass bottles of various sizes (500 c.c. 1 lit. 2 lit); Rubber tube 5 mm.; Wrist-watch with a centre second hand, or clock; Water bucket or tub.

C = Catalyst L = Learner

C. What do you need every day ?

L. Food, water, air, clothes, exercise....

C. Of these which are more important ?

L. Water, air.

C. How do we measure them ?

L. Milk is measured in litres; so may be water can be measured in litres.

C. What does a litre mean ?

L. It is a measure.

C. What property of milk does a litre measure ?

(There is a lot of confusion and the students say that the litre measures milk)

C. If you take one litre of different substance such as water, kerosene, petrol and milk. What is the common thing i.e. one litre, in all these signify ?

L. They all weigh the same.

C. Does one litre of milk and one litre of water have the same weight ?

L. No.

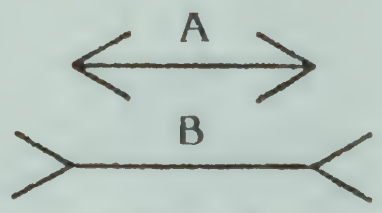


Fig. 2

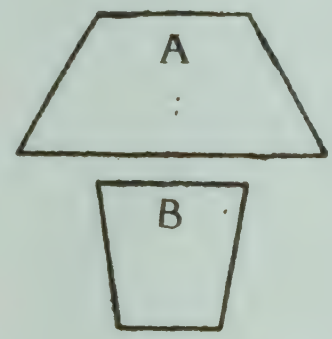


Fig. 1

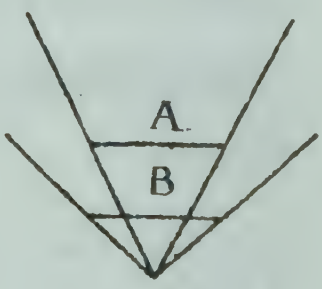


Fig. 3

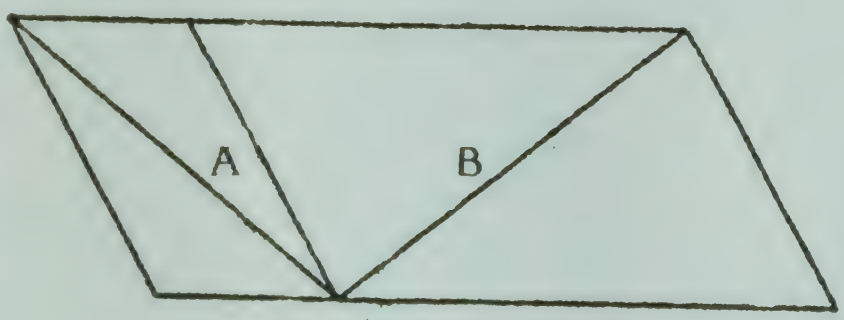


Fig. 4

Look at the figures in the above illustrations. Are the lengths of lines A and B equal Measure the lines and check your answer.

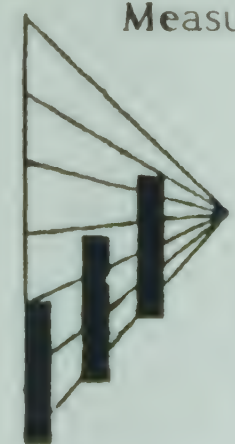


Fig. 5

In Fig. 5, which of the three colums in bigger?

Check your answer with a ruler.

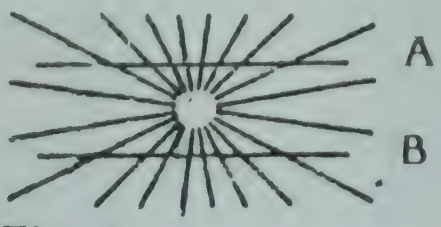


Fig. 6

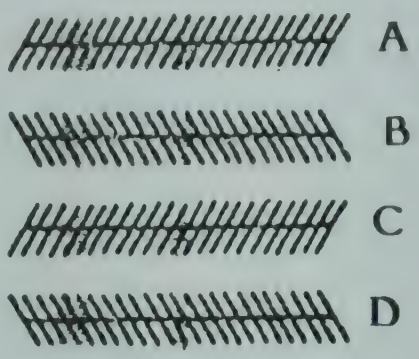


Fig. 7

Are the lines AB in figure 6 and ABCD in Fig. 7 parallel?

Check Your answer.

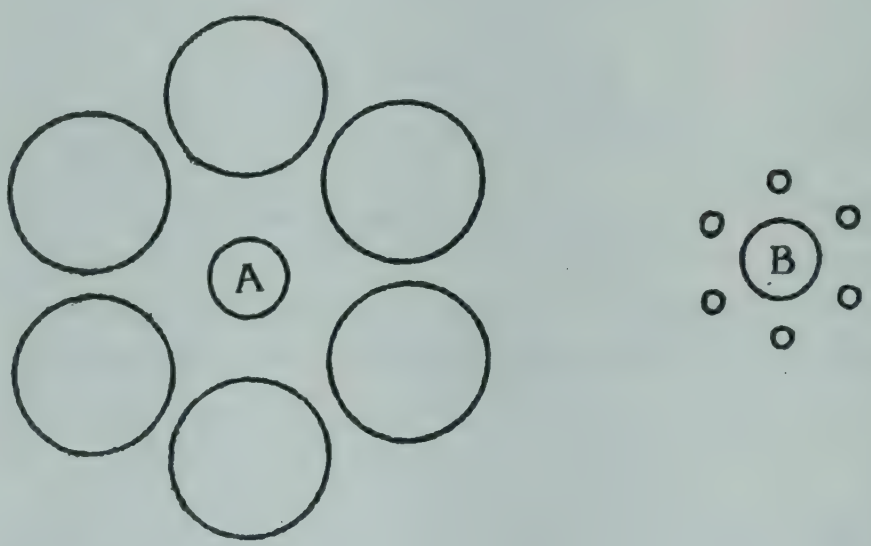


Fig. 8

Are the two circles A and B in Fig. 8 equal in size?

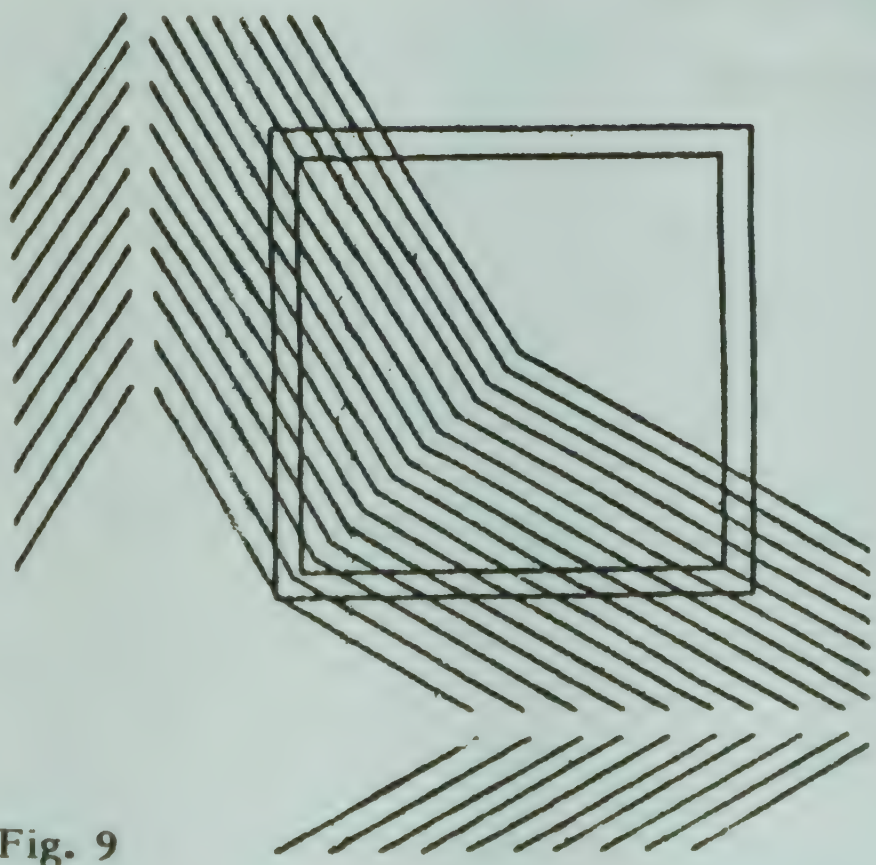


Fig. 9

Is the four - sided figure a square?

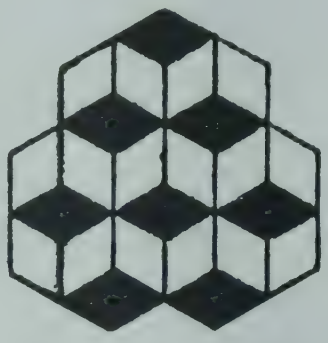


Fig. 10

What is the number of cubes in Fig. 10? Six or seven or both?

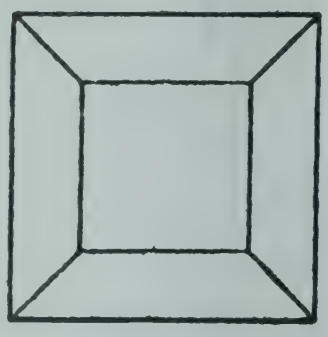


Fig. 11

In the above Fig. 11, is the central square in front of the outer square or behind.

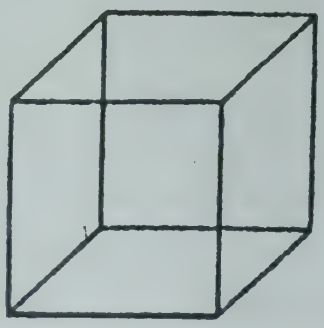


Fig. 12

In Fig. 12, are you looking at the top of the cube or the bottom of the cube?

C. How is one litre measured ?

L. By using a measuring vessel.

C. What is heavier, kerosene or water ?

L. Water — because kerosene floats on it.

C. Will the weight of one litre water and one litre kerosene be the same ?

L. No.

C. So, what does a litre represent ?

L. Volume.

C. Do you know how volume of a solid is measured ?

L. Yes sir, length × breadth × height

C. I have a cube here. It has length, breadth and height equal to 1 cm. What is the volume of this cube ? (Cubes are passed around)

L. 35 cm, 6 cm, 1 cm etc.

C. Let us use your formula for volume i.e. length × breadth × height and do the calculation:

L. Volume of the cube = length × breadth × height
= 1 cm × 1 cm × 1 cm
= 1 cm^3 or 1 cubic centimetre or 1 c.c.

C. Now let us take two cubes and place them side by side. What is the volume ?

L. 2 c.c. Because there are two cubes each having a volume equal to 1 c.c.

C. Let us use the formula l × b × h and see if the answer is correct.

L. 2 cm × 1 cm × 1 cm = 2 cm^3 or 2 c.c.

C. Let us take four cubes and arrange them in different ways: What is the volume ?

L. 2 × 2 × 2 cm^3 = 8 cm^3

C. Let us learn a simple technique of measuring volume of liquids by using this apparatus known as a measuring cylinder. (The teacher gives the students measuring cylinders containing some water).

C. What is the volume of water contained in your measuring cylinder ? (students learn the technique of measuring volume

correctly with the help of a measuring cylinder). The teacher now asks the students to drop 5 cubes into the water and find out the change in volume.

(The volume displaced is found to be the same as the volume of the metal cubes sunk into the water. Through this experiment and discussion the students arrive at a conclusion that when any object sinks in water the volume of water equivalent to the volume of the object is displaced.)

C. Now how will you measure air ?

L. By filling a balloon.

C. How will you find out the amount of air contained in the balloon ?

L. By weighing. (Experiment is carried out on weighing an empty balloon and the same balloon with air, in a balance of 100 m gm accuracy. No difference in weight is noticeable).

C. The weight difference is very difficult to observe in the equipment available. Can we measure any other property of air ?

L. The volume can be measured. (After some discussion with the students, it is realised that the volume of air can be measured by displacing the water held in a bottle with air.)

C. How many times do you breathe in a minute ?

L. 15, 20, 25, 30.....

C. Boys, breathe as slowly as possible and see what is the minimum number of times you breathe in a minute. Now let us try an experiment to calculate the amount of air we exhale in a breathing cycle.

(The students set up an experiment by filling the bottle with water and inverting it in a bucket half filled with water and putting one end of a rubber tube in the mouth of bottle. The students take a deep breath and pass exhaled air through the tube into a 500 c.c. bottle. Many students find that the water in the bottle is emptied out and the air escapes out) This is discussed and a larger bottle is taken. The students finally succeed in trapping all the exhaled air in the bottle.

C. How will you measure the volume of exhaled air trapped in this bottle ?

I. By measuring the capacity of the bottle and deducting from it the volume of water present in the bottle. This gives the amount of air exhaled.

(This experiment is carried out three times and the average amount of air exhaled per minute calculated assuming that the amount of air exhaled is the same as the amount of air inhaled. From this the amount of air required every day by each student is calculated.)

How much oxygen does air contain ?

Materials:

Test tubes or measuring cylinders; Beaker; Steel wool.

C = Catalyst L = Learner

C. What is air made up of ?

L. Oxygen, nitrogen, carbon dioxide, argon, moisture etc.

C. Is there a simple way to find out how much oxygen is there in air ?

L. By burning candle or phosphorus in air and allowing water to take its place.

C. We do not have phosphorus. How will you carry out the candle experiment ?

L. Take a trough, fix the candle by melting some wax into it. Half fill the trough with water. Light the candle and invert the glass jar over it. The candle burns as long as there is oxygen in the glass jar. The water rises in the glass jar. The rise of water in the glass jar gives the per centage of oxygen in air.

C. There are several problems in this experiment. The hot flame gives out hot gases which expand the air. Hence, the volume of oxygen obtained is not reliable. Candle stops burning even though there is oxygen in the glass jar. Carbon dioxide formed by burning candle and nitrogen present in air do not support the burning process. Depending on its height the candle will stop burning at different times.

C. Do you know how iron rusts ?

L. Iron rusts when it uses oxygen in the air.

C. In which season does the rusting process becomes faster ?

L. During monsoon.

C. The iron rusts much faster in the presence of water and as you have said in this process oxygen from air is used up. Can we device an experiment which will measure the percentage of oxygen in air ?

(After some discussion, the students decide to carry out an

experiment as follows:

A wet steel wool is placed at the bottom of the test tube and the test tube was inverted into a beaker containing water. As rusting is a slow process, the experiment was observed after three days and the rise in water level converted into the percentage of oxygen present in the air. The percentage of oxygen found in the air by this method was near about 20%).

Surface Tension

Materials:

Beaker; Blade; Tin (small petrol can); Small light string; Shallow dish; Match sticks; Spirit or alcohol; Soap solution; Cardboard piece; Small piece of soap.

C = Catalyst L = Learner

(Discussion was started by showing to the participants a blade floating on water).

C. What is the blade made of ?

L. Iron.

C. Is iron heavier than water ?

L. Yes.

C. Then how does the blade float on water ?

L. We can see that surface tension supports the blade.

C. What is surface tension ?

L. I know but I cannot explain.

C. Liquids form a film on the surface due to cohesive force of the molecules. For example, if you take a beaker full of water, molecule 'A' which is well inside the water will be attracted on all sides by the surrounding molecules and hence it is stationary. The net force on the molecule is zero whereas molecule 'B' which is on the surface is attracted only by the side molecules and the molecules lying below it. Thus it is pulled downwards. This happens to all the molecules on the surface and they all form a tightly stretched film. This phenomenon is called surface tension. Suppose, we take a tin with holes at the bottom and we fill it with water, what do you think will happen ?

L. Water comes out with a force from all the holes.

C. Now, if you try to plug the jets of water, what will happen ?

L. The water will stop flowing.

C. Why would the water stop flowing ? (No answer)

Well, let us do an experiment. (The students try to do the experiment)

C. Now can you say what happens when we try to plug the jets of water ?

L. They all join together to form one.

C. If you try to break them apart, what will happen ?

L. They again form individual streams.

C .Can you tell me why this happens ?

L. Yes, it is due to surface tension. When we plug the jets, we force the water molecules to come together and once that happens the cohesive force holds them together till you break them apart.

C. Suppose we take a loop of wire and dip it in a soap solution, what happens ?

L. A thin soap film will form on the loop.

C. Now if you make a small loop from a thin thread and leave it on the film what will happen ?

L.1 The film will break.

L.2 The thread will float on the film.

C. Suppose the loop floats on the film and if we pierce the film in the centre of the loop with a hot wire, what will happen ?

L.2 The loop will contract and fall off.

L.1 The whole film breaks.

C. O.K. Now let us try to see it. (students try)
Now can you tell what will happen when the hot wire pierces the film in the centre of the loop ?

L. The loop which is irregular in shape becomes a perfect circle.

C. Do you know why ?

L. May be the hot wire did the trick !

C. Well try and break the soap film with your finger nail.

L. The loop becomes a circle.

C. How is that ?

L. When the film inside the loop is broken, the force that holds the loop breaks down. Now only forces outside the loop act on it equally in all directions and pull the loop in the same way and hence the loop becomes circular.

C. Now, if we place two match sticks on water side by side and put a drop of spirit in the centre what will happen ? (No answer) Let us see. (students try it)

L. The sticks move away.

C. Take just one stick and place a drop of alcohol on one side. Now tell me what happens ?

L. The stick moves away in the opposite direction.

C. How is that ?

L. There is some force acting on the stick.

C. Do you know what happens if you try to break a piece of stretched rubber from the middle ?

L. Yes, the other two pieces fly off in opposite direction.

C. Now, can you think why the match sticks do so ?

L. Yes, the stretched film due to surface tension is broken by putting alcohol and hence the sticks fly apart.

C. If you take a small cardboard piece, cut it in the shape of an arrow with a wedge on its tail and place it in water, what will happen ?

L. It will not move. It will just float.

C. Now, if you put a small piece of soap in the wedge, what will happen ?

L. The arrow will start moving.

C. Why does it move ?

L. This is also on the same principle. Soap reduces the surface tension which breaks the film and pushes the boat in a forward direction.

Classification

The world around us is full of a variety of things. In our room, we find books, furniture, clothes, walls, windows, electric light, fans and so many other things. Similarly, we find many things in the kitchen which are of different types — vessels, spices, cereals, vegetables, fruits, tea, coffee, fuels etc. If we go to the city shops, we can see

thousands of types of material used in homes and industries. In order to understand about the variety of things around us, we usually classify these things into various groups based on one or more observable properties.

Classification may be based on any criteria selected by us. For example we find things in air, in water and on land. Hence, a classification may be based on where things are found.

Air	**Water**	**Land**
Aeroplane, helicopter, bacteria, dust particles, birds.	Fish, plants, boats, submarine, microscopic living things.	Animals, plants, motor car, trains, houses.

Similarly, we can also classify things as living or non-living on the basis of properties such as growth, metabolism, movement, response to stimulus and reproduction.

Living

Plants Animals

This could be further sub-classified. For example:

Plants

Trees Shrubs Creepers

A non-living thing can be classified on the basis of the state. For example.

Non-living

Solid Liquid Gas

The solids could be classified further on the basis of their lustre and conductivity. For example:-

Solids

Metals Non-metals

The metals could be further classified on the basis of chemical reactivity. For example:

Metals

Noble metals such as gold, silver, platinum which are not reactive	Other metals which are more active

The non-metals could be classified on several basis such as electrolytes and non-electrolytes depending on whether their solution conducts electricity or not, or as organic and inorganic depending on whether they are made up of carbon and its compounds or of other elements. The classification could also be based on purity, crystalline structure, commercial uses, chemical nature and many other factors.

The liquids could also be classified on several basis such as electrical conductivity, polarity, viscosity, flamability, boiling point, density, refractive index etc.

Gases can be classified on the basis of reactivity, colour, solubility, density and other properties.

Apart from such classifications we can classify items in daily use such as fuels also in several ways:

Fuels

Solid	**Liquid**	**Gases**
Wood, coal/ charcoal, cowdung cake	Kerosene, diesel, furnace oil.	Natural gas (methane) coal gas; bottled gas (butane) sewage gas (largely methane)

Cloth can be classified as natural or artificial.

Fabric

Natural fibres Artificial fibres

Natural Fibres

Plant origin: Cotton, jute, flax	Animal origin: Wool, silk

Among artificial fibres, we have fibres which are regenerated fibres

such as viscose or cuprammonium. These are made from polyamide, polyester, acrylic and polyene fibres.

Water can be classified in several ways depending on salts dissovled in it.

Water

Hard water	Soft water
does not give lather when a small amount of soap is dissolved in it.	gives lather when a small amount of soap is dissolved in it.

Similarly, we find that all the cereals are classified into district names depending on variety or place name. Even sugar has its own classification depending on crystal size and whiteness of grains. Thus almost all the materials we consume or use are classified in several ways to meet the needs of people in various regions. The classification criteria many times varies from place to place depending on local demand and preferences.

Animals

Those living on plants	Those living on other animals

The animals may also be classified in several ways. For example:

Animals

Those living in water	Those living on land
	OR
Animals having skeleton	Animals without skeleton
	OR
Animals which suckle their young ones	Animals which do not give milk

Classification makes it easy for us to understand the world around us by splitting the things into several groups with common properties. Classification is made in most of the human activities, e.g. management, accounting and budgeting. We classify the various behaviours of human beings. We not only classify things but also the feelings. Classification is almost the back bone of most of the activities of human beings.

Observation and Measurement

Dr. Mala R. Chinoy

Observing insects

Many of us see, but very few really observe. Seeing involves only one of our senses — the eyes, whereas observation needs sharpening of all our senses and also involves coordination with the brain. This leads to focusing, thinking, understanding, interpretation and detailed discovery of the object under observation. Seeing could be common or same for all with vision, but observation is unique to each individual.

It wouldn't be improper to say that I was led into becoming a formal biologist through my basic habit of observation. Observation became a habitual passion for me with regard to the living and non-living things in the immediate surrounding and environment as a whole. Later, I chose to concentrate on the living things.

My first exciting drama with the school children began by lifting the curtain from the commonly unnoticed world of insects. Inspite of being all around us and the largest group of organisms in the living world, they were only being seen, not observed.

Insects are common in just about every environment, hence easy to find. They can usually be approached close and are mostly harmless. Children found them really fascinating!

Once we started our interactions, insect observation became the most interesting and passionate hobby of these children and they began to discover and observe these fascinating creatures in every possible location.

Tools to get a better look at insects

To my mind children need only a magnifying lens. But, if one finds a dead insect then a microscope too. Many entomologists use various kinds of nets and jars as insect-trappers, but we need not do so. Our aim is only to try to lead children to see what they otherwise don't get to see or even notice.

How to recognize an insect ?

Insects are most commonly confused with shrimps, millipedes, spiders etc. But the latter three fall into entirely different groups of

organisms. The following features of insects may be kept in mind to facilitate insect identification:

1. Insects by rule have three major divisions in their bodies — head, thorax and abdomen.

2. Adults have three pairs of legs, all attached to the thorax, the middle section of the body.

Ant, fly, grasshopper, cockroach and beetle are insects, whereas, spiders since they have 4 pairs of legs and only two body-divisions, are not insects.

Insects are very interesting forms. They change a great deal during their lives. Most of the time each stage is entirely different from the other.

By observing the development of a butterfly and a cockroach, children can learn about the two different types of development in insects — Complete Metamorphosis: egg, larva, pupa, adult; Incomplete Metamorphosis: egg, nymph, adult.

Exercise A

Observe the development of the following insects and say whether it has complete or incomplete metamorphosis.

dragonfly	beetle
housefly	moth
mosquito	leaf-hopper
silverfish	grasshopper

Eight major orders of insects

1. Hymenoptera — bees, ants, wasps
2. Diptera — houseflies, mosquitoes
3. Lepidoptera — moths, butterflies
4. Coleoptera — beetles
5. Orthoptera — crickets, grasshoppers, locusts
6. Odonata — dragonflies, damselflies
7. Homoptera — aphids, cicadas, leafhoppers
8. Hemiptera — bugs, backswimmers, water-striders

Exercise B

- Did you know that bees, ants, and wasps are insects which build organized colonies and that these colonies are totally female colonies ?

What happens to the males ? Do they exist ? If yes, where ?

- Ants have no wings, houseflies have two wings and cockroaches have four wings. Inspite of this difference, they are all insects, as their bodies are divided into three parts and each has three pairs of legs.

What is the powdery stuff on the wings of butterflies and moths ?

- Why do beetles have hard sheath wings ?

- Can all insects smell ?
- Can all insects hear ?
- Can all insects produce sound ?

Have you ever heard insect sounds ? If yes, which ones ?
How do insects produce sounds ?

- How are dragonflies different from damselflies ?

- Have you ever seen insects with transparent wings ?
  Which are these insects ?

- What are bugs ?
  How can you identify them ?

Insects are found in the most beautiful variety of shapes, sizes and colours. They can be best known through their inter-relationships, life cycles and usefulness or harmfulness to humans.

Exercise C

- Can you name some insects which are useful and some that are harmful to mankind ?

  This usefulness and harmfulness does not mean that they are so even for the environment or other forms in the environment. In fact, all living forms are integrated parts of the living world.

- Can you tell the sources of lac, honey and silk ?

This is only one simple example of leading children into environmental and nature studies at the school level. Birds, trees, flowers, leaves, fruits, seeds, feathers, colours, human habits, culture, domestic and wild animals, aquatic animals and several other such objects of nature can be taken up as topics for discussion separately or as a part of the curriculum in the school.

Measurement

Observation leads to some form of comparison and thus to measurement — either approximate or exact. Even approximation needs thinking, concentration and judgement. It definitely involves using our senses to get an idea about the measurement of any object.

Simple exercises as follows can really help a child's mental progress and also satisfy its curiosity about the dimensions, distance and depth of the things around us.

Exercises

(i) Compare your heights directly by standing closely to one another.
(ii) Measure your height with a ruler or measure-tape.
(iii) Measure it with a palm-stretch.

- Measure the width of a table.

- Measure the distance to school — for this the child must know the average length of his pace.

- Measure the circumference of a tree.

How do you expect a child to do these exercises even in approximate measurements ?

Certain basic things that a child must know about himself:

(a) The length of his palm-stretch, from the tip of his thumb to the tip of his middle finger.

(b) Average length of his pace.

(c) Distance between the finger tips of his stretched arms.

Such basic exercises about of one's own self would lead to comparative measurements between different children in the class-room, and later, measuring different objects approximately.

Besides using one's own body parts to measure dimensions and distances of objects, we can also familiarise children with the various devices man has developed to accurately measure things, e.g. the following instruments are used to measure length:

ruler measure-tape
micrometer sliding callipers
curvimeter

Exercises

- List the ways in which the following things can be measured: Volume, area, depth, number, weight, time, motion.

- List the units for measuring each of the above.

- The speed of a moving object tells us the distance it covers in a certain time. It is described in kilometers/hour or metres/second.

Faster and faster

A walking person 4 km/hour	A horse 90 km/hour	An ostrich 97 km/hour
Light waves 3,00,000 km/sec.	A jet plane 3,600 km/hour	Sound waves 340 m/sec.
An express train 210 km/hour	A dove 130 km/hour	A cheetah 110 km/hour

(a) What do you mean by a similarity between two objects? Is it a kind of comparative measurement?

(b) What are equalities?

(c) Find appropriate examples of similarity and equality in nature and plan an interactive programme with children.

(d) How can the emission of sound, its frequency and audibility be measured? What are the units used in their measurement?

These exercises could be further elaborated to improve the understanding of the children regarding their own surrounding, self and the world in general. Do make an effort at writing down some simple exercises for children in your schools or at home. This is the best way of contributing to the cause of environmental education.

Craft Activities

Ramesh Kothari

Children love to romp about in nature. Their curiosity makes them investigate their environment. They love to create things from natural as well as man-made materials. For them, most of the things they make are playthings, but a planned environmental craft programme has the following advantages:

1. It encourages creativity.
2. It makes a child more observant.
3. It helps a child to perceive certain scientific details.
4. For an activity like model making, the child is encouraged to analyse a complex object and concentrate on essentials. This helps in understanding the object better.
5. It satisfies an innate-desire to collect and classify.
6. It helps in creating environmental displays for clubs, exhibitions or a mini-museum.

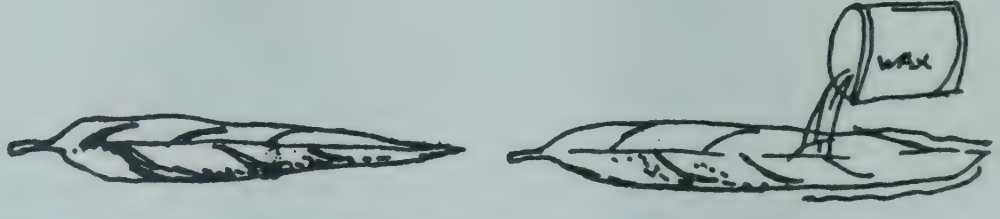
Those who work with children will understand the need of self expression in terms of activity as opposed to a direct verbal teaching-learning process. Activity-oriented sessions bring about greater participation and creativity.

While taking up environmental craft, the child has to observe objects or phenomena which it wants to reproduce in terms of a model or a toy, e.g. if the child has to make a clay model of a bird, it will have to keep the minimum major features before its memory screen. The child wanting to make a water bird would always make the bird's neck and beak longer. This does not mean that a craft activity leader should insist on absolute reality. He or she should guide them to recreate the thing in terms of broader features.

A child enjoys learning scientific details through craft activities. By making a paper flower after observing a real flower and learning a few facts about it, the child finds working on the model flower very meaningful.

While doing environmental craft activity, the children collect natural as well as man-made things in large numbers and this can form a good basis for starting a classification and collection activity.

After classification, display is the next logical step. Display of things made by them matters quite a lot to children. It also involves many



Can we get a print if we pour wax on it?

non-participating onlookers in the activity. It draws from the onlookers, who form a group that will ultimately join the action group. Thus, environmental craft activity is not just a craft activity but an organic part of a total scientific knowledge the child builds for itself.

Some Sample Craft Activities

.. Leaf rubbing
.. Leaf foil prints
.. Bark printing
.. Paper flower making — leaf and flower spray prints
.. Paper leaf making
.. Animal origami
.. Clay model making
.. Plaster casting of animal footprints
.. Cardboard and stiffboard models
.. Nature Jigsaw puzzle making
.. Photograms of natural objects with simple photographic materials
.. Puppet making and puppet operation
.. Art activities — symbolic drawings — how to do and how to use ?

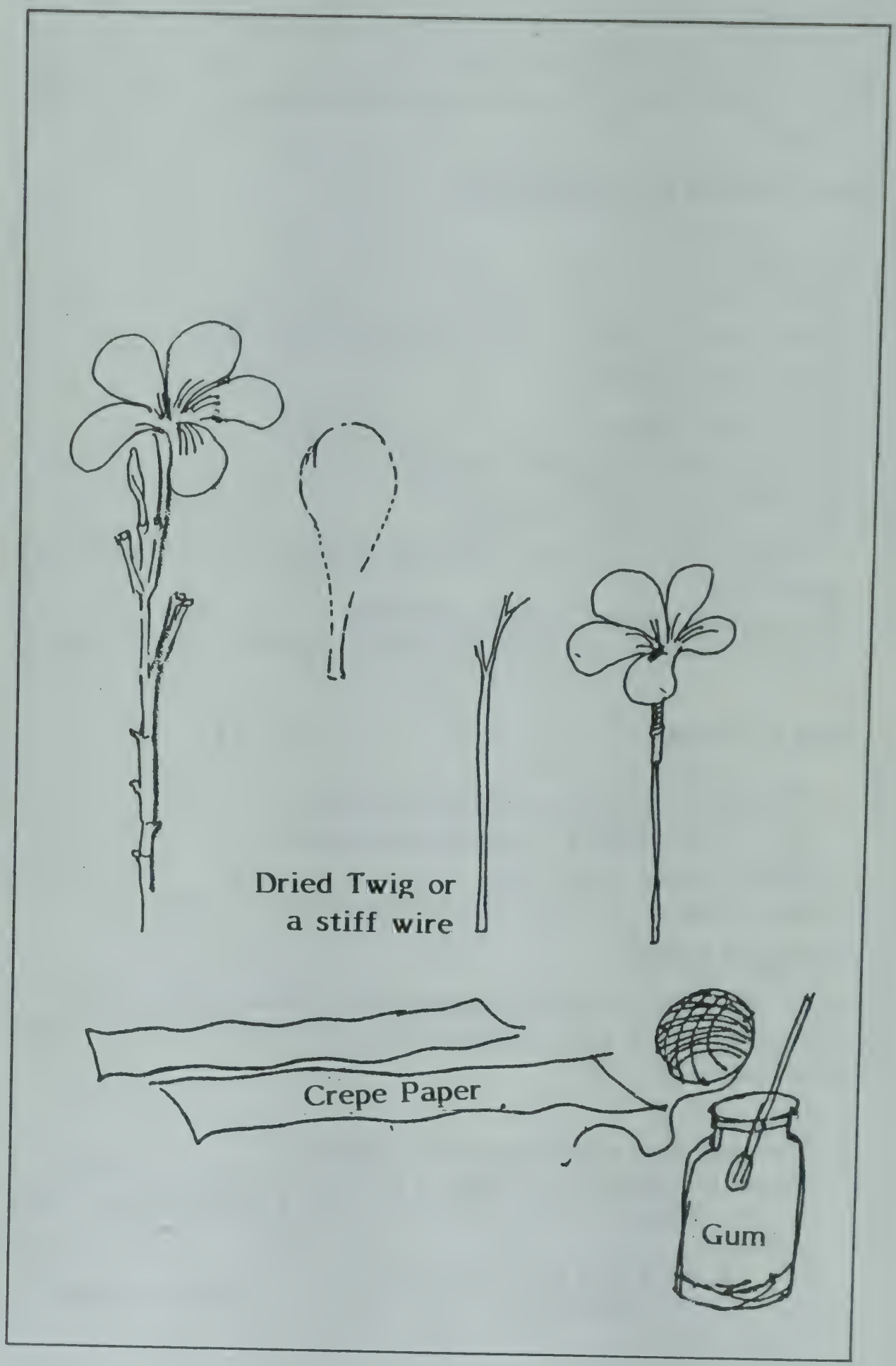
Leaf Rubbing

. Take a leaf.
. Put it flat on a smooth and hard surface.
. Take a paper from an ordinary note-book.
. Fold the paper on the leaf.
. Rub over the leaf with a soft black pencil or a crayon.

Foil Leaf Prints

Cigarette or other foils are thrown away by the product users. They have a very good potential for making excellent foil impressions. (see fig.1)

. Take the leaf.
. Put it flat on a smooth and hard surface.
. Smoothen the foil by rubbing a pencil over it several times.
. Lay the foil on the leaf and rub it with a thumb using a little pressure.
. You will get a very clear vein impression on it.
. Cut out the leaf impression with a pair of scissors or a blade.
. Care is necessary while using cutting equipment.


Dried Twig or
a stiff wire
Crepe Paper
Gum

Bark Print

Children of the age 9-10 learn to cut things and shape them.

. Cut a dried branch of a tree approximately, 2 cm in diameter.
. Put thin paper around it and rub it with thumb thoroughly to get a good impression of the bark.
. Pencil rubbing can be excellent.

Paper Flowers

Paper flower making has been a traditional activity among many communities.

To make a nearer replica of a flower, it is useful to take one flower and analyse its petals and other structures.

E.g.: If you want to make a Champak flower, then, take out one of its petal, trace it on a sheet of crepe paper. It can then be bound and moulded into the desired form. Keep the petals long enough so that they can be tied with a string to a wire stem.

The parts like Stigma, Ovary, Calyx etc. can be made with little pieces of wire, paper or other materials. (see fig.2)

Paper Leaf Making

Paper leaf making is a good nature learning activity.

. Paste paper on both sides of the leaf with gum or fevicol.
. Cut out the leaf shape and with a pointed end of a pencil press in veins.
. Colour it.

Animal Origami

Origami is a fascinating craft. Paper animals which are most symbolic in form are enjoyed by children as well as others. The basic fold is the bird base and once it is mastered, many interesting forms can be created.

Animal and Bird Model Making

Children's perception of animals and birds often appears to be emotional. Sometimes a child may make a parrot much bigger than a peacock, but all the same, children pick up major characteristics of a certain animal or a bird. The major components of a bird are: round head, connecting neck, oval body, a tail and legs.

Four-footed animals will have the following major components: oval

head and face, connecting neck, cylindrical body, legs and tail.

Clay is the best material to work with and children who work on these projects have been producing broad forms. (see fig.3) Where it is hard to produce technical details in one media, other media can be supplemented.

E.g.: Long legs of a heron may not be practicable on a clay model and therefore, it will be worthwhile to make children do that exercise in terms of graphic. They should also be encouraged to work with local craftsmen who can initiate them to papier mache.

Children tend to invent their own structural solutions and therefore forms made by them deviate from very realistic forms.

Stiff Chart Board/Card Models

Stiff chart board has several possibilities in terms of making models.

Animals like tortoises, cut-outs of snakes and skeletons of different animals can be made from these materials (see fig. 4)

Safety is necessary while using sharp cutting gadgets.

Realistic colours can be applied by means of normal poster colours or low-cost crayon.

Jigsaw Puzzles

Younger children enjoy jigsaws especially nature related ones.

. Paste a visual on a discarded hard cover of a note book.
. Cut it into smaller irregular shapes and store these in a plastic bag labelled with the name of the visual.

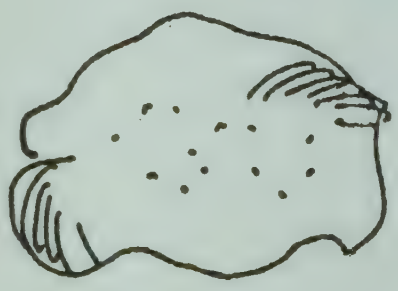
Spray Prints

Spray prints can be done using a discarded toothbrush and a comb.

. Take a white paper.
. Put a leaf on it.
. Dip the toothbrush into thin poster paint and with the help of the comb spatter the edges of the leaf.
. It will produce a spatter picture.

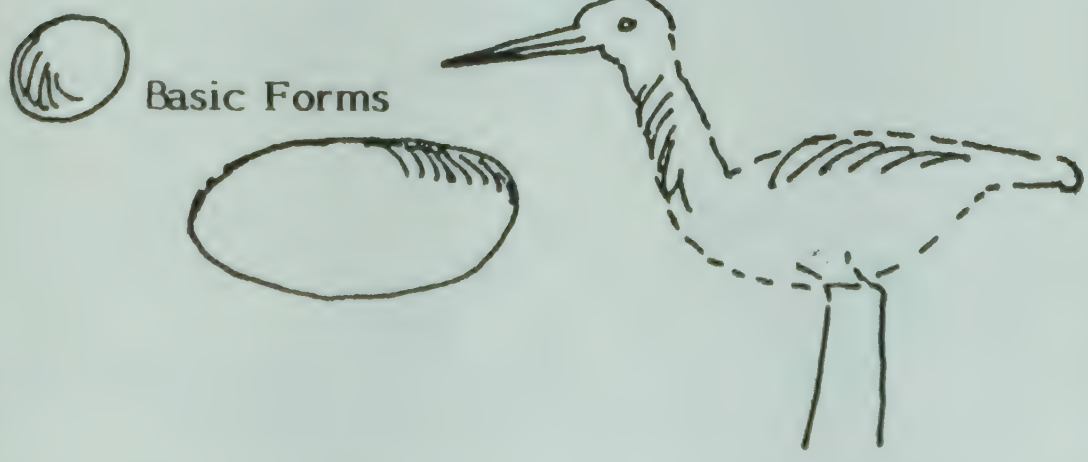
Photograms of Natural Objects

Once in a while, children enjoy making photographic images with simple photograms.

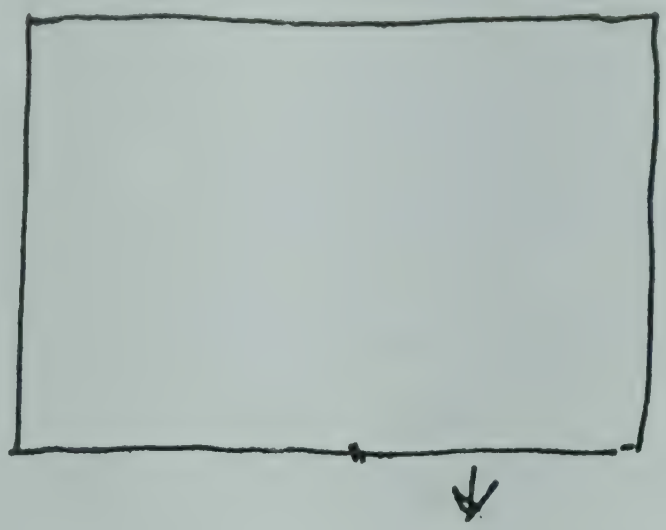


Clay

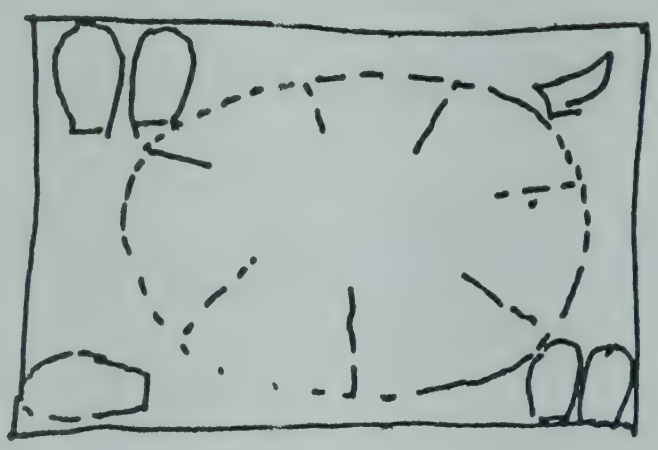
Basic Forms



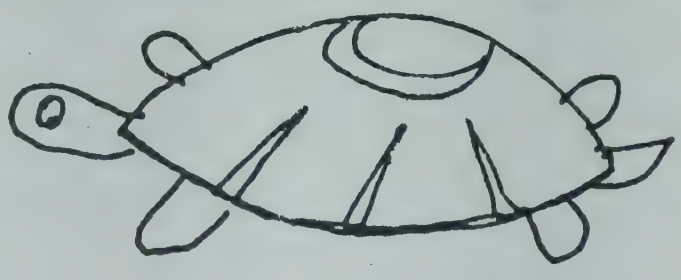
Basic Forms



Stiff Chart Card



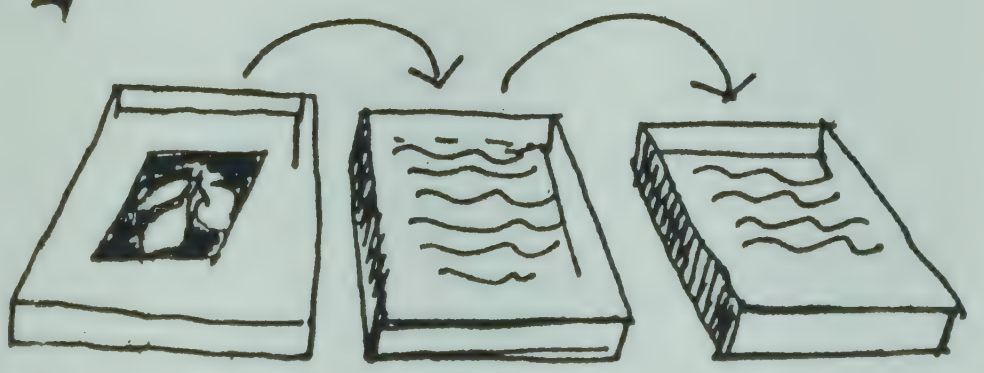
Basic cut out



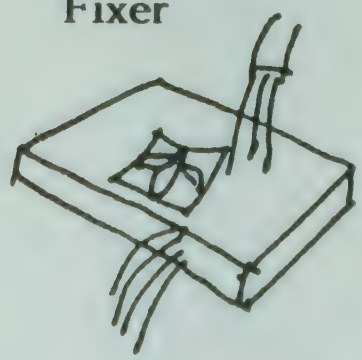
Three Dimensional Form

Red Celopmane Double or
Triple Layeaed safety light

Photo Paper



Developer Stop Bath Fixer



Washing in Running Water

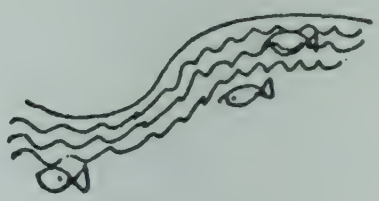
Symbolic Drawings

Cloud

Water Tank

Sun

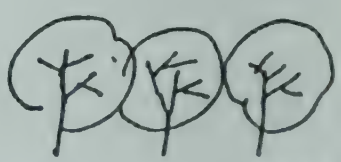
Tree



River

House

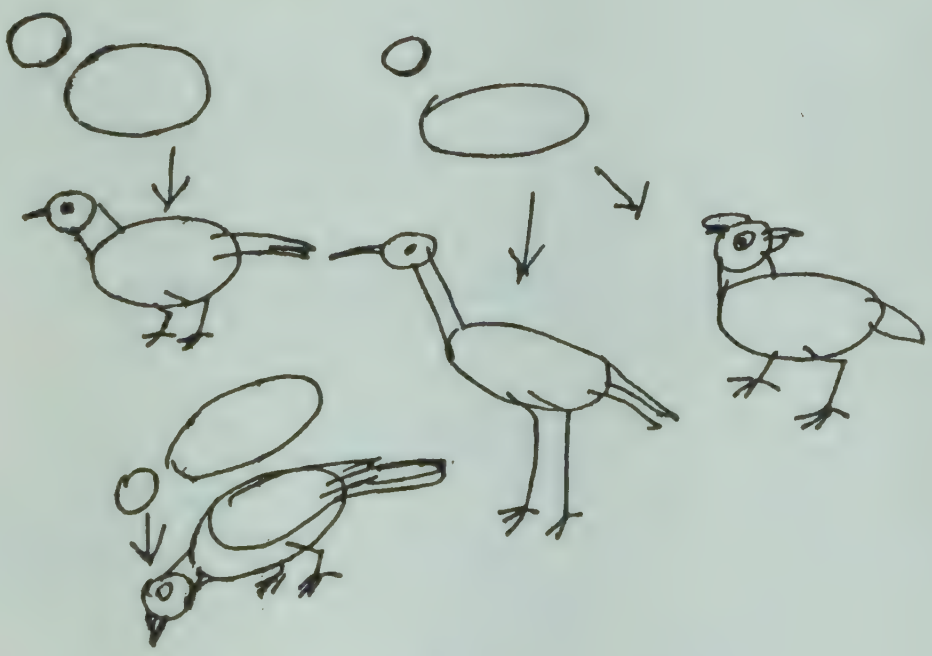
Factory



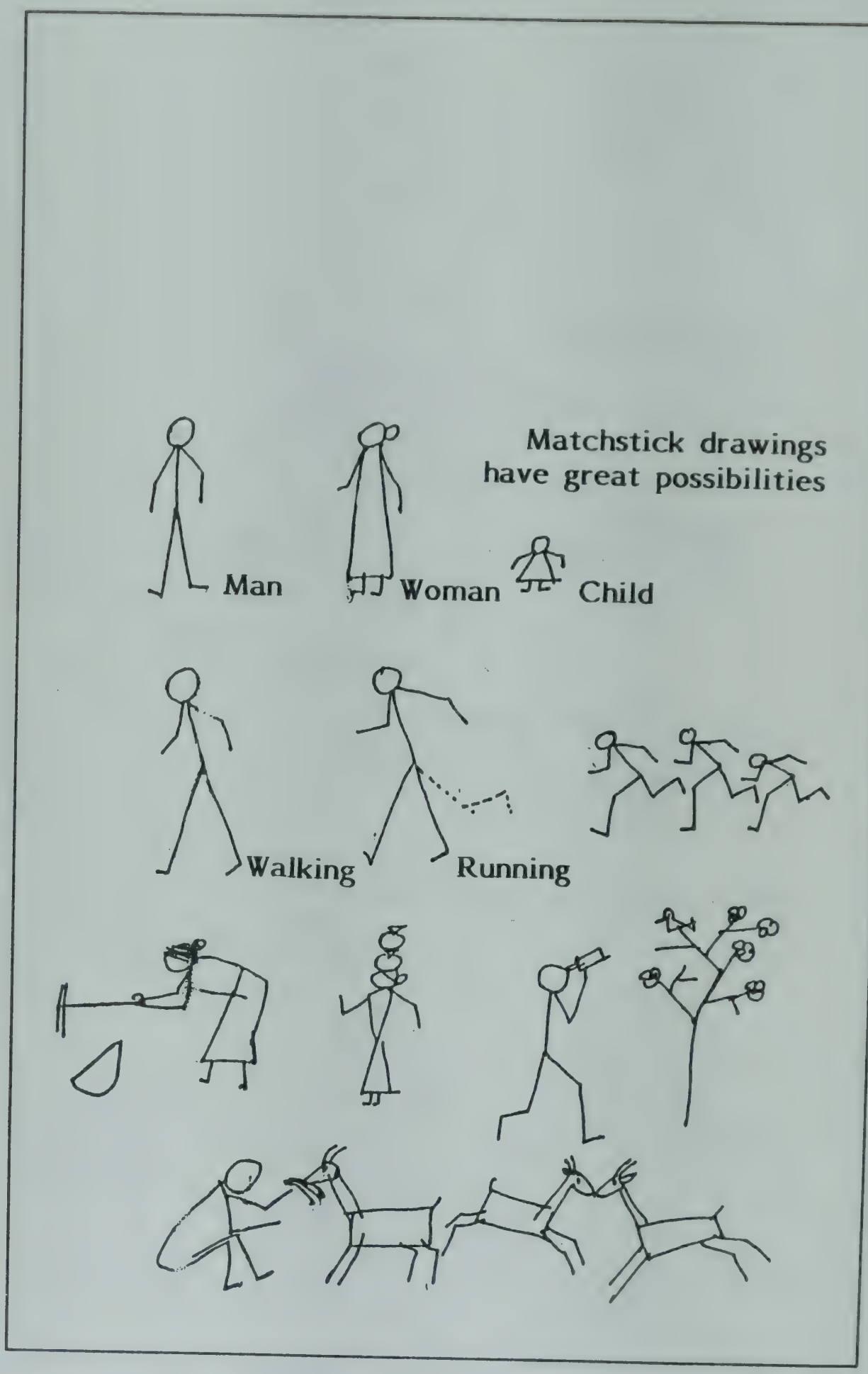
Woods

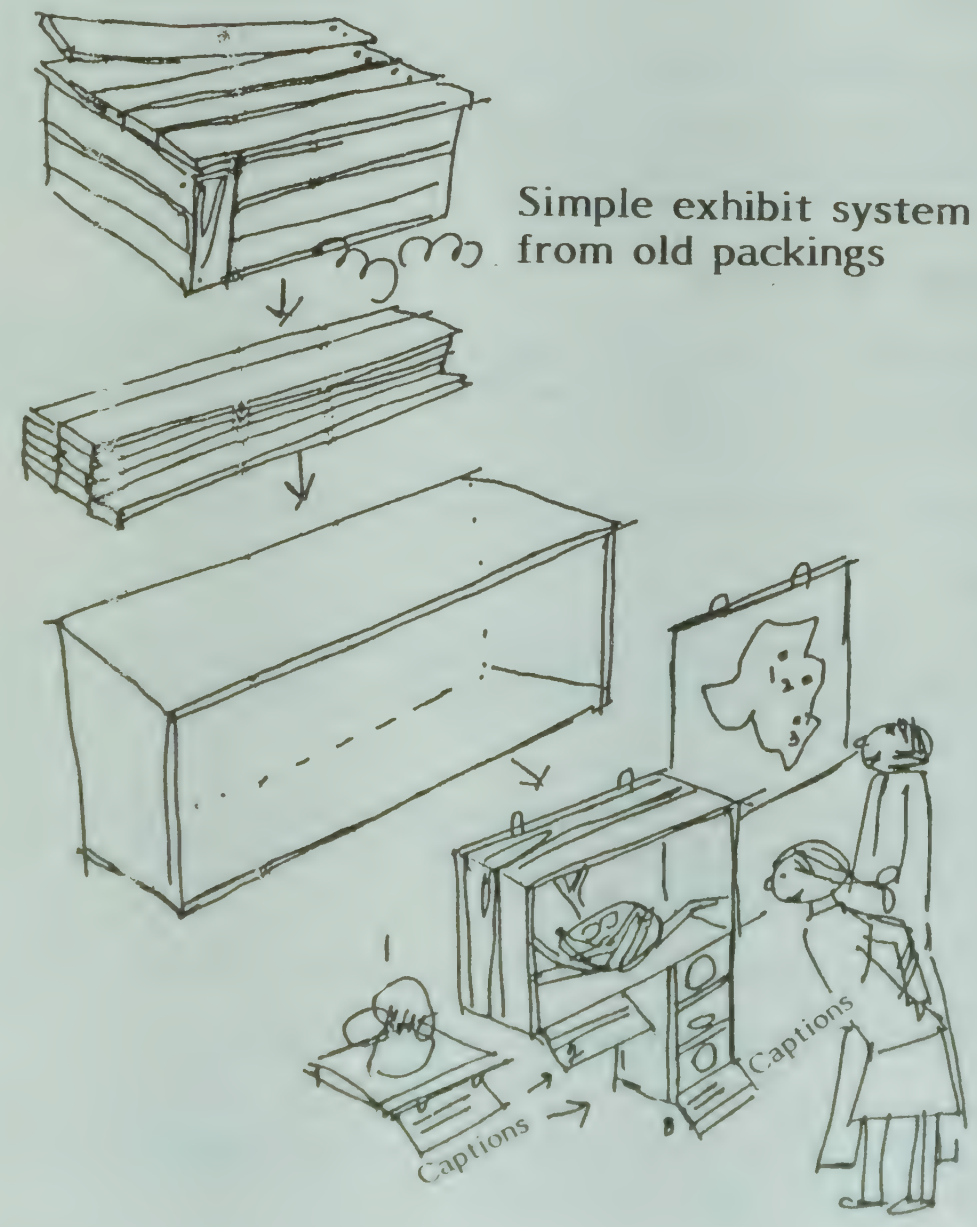
Bird

Drawing a Bird



Drawing a four footed animal


Matchstick drawings
have great possibilities
Man
Woman
Child
Walking
Running



Simple exhibit system
from old packings

For photograming, children may need a completely darkened room with red light (a local photographer's advice will be useful).

. Take a photo paper.
. Put on it any object like a flower or a leaf.
. Let white light fall on it for a few seconds.
. Develop it in the developer.
. Once the image comes out dark enough, put it in a plain water stop-bath and transfer the print into the fixer.
. Let it be there for five minutes and then wash it with running water. (see fig. 5)
. The print can then be dried.
. For taking a contact print photographic paper is recommended.

Puppetry

Various simple methods are there in this type of performing arts. Children enjoy working with puppets. Glove puppets are easy to operate and produce desired results. Puppet making is an excellent activity too.

Symbolic Drawings

Easy to make symbolic drawings are advantageous for the children to take up. Symbols of birds, animals, trees and human beings can be tried (see figs. 6,7,8).

Matchstick drawing technique is very practical.

Display

A small exhibit requires a simple understanding of display techniques. The following are some points which can be considered for a simple display:

1. The displayed object should have a clean background so that it can be seen properly. This can be achieved by using a coloured board or coloured paper.

2. It should be at eye level so that children can see it easily.

3. Objects can be displayed in logical groups.

4. Captions can be done by a sketch pen. Captions should be uniform in colour and paper and, as far as possible, in the same style and width of letters.

   Decorations do not help very much in creating good captions. Where necessary, show the location of an object.

5. Simplified schematic drawings can explain an object better.

6. After use, the objects can be stored in a tin box to form a larger collection. School walls can be furnished with re-cycled packing boxes which will serve as simple display units (see fig. 9).

Learning Through Games

Ramesh Uttam and Ramesh Kothari

Most animals which have some degree of social interaction teach their young through play. Such learning is directed towards their survival as individuals and also as members of the group or species. Games, whether they simulate life-like situations or provide recreation through escape mechanisms, are an important part of play.

Broadly, games engender:

- the creative involvement of the participant using most if not all senses of perception;

- the acquiring and refining of skills of observation, classification, synthesis and interpretation involving among others the making of simple value judgements;

- curiosity, competence, compassion and confidence through self and group reliance and serve a useful social function.

- (an environment for individual creativity and innovation within the) framework of rules;

- the easy communication of abstract and possibly complex concepts.

Consider the sequence of the following games:

a) Who Am I?
b) The Poet in the Child; and
c) The Web of Life

This sequence of games is designed to build up from identifying, expressing, working out the independence and inter-dependence of the many aspects and gaining insight into the functioning of the "Web of Life"

Similar sequences are possible with games created to communicate virtually any concept or aspect.

Now consider individual games like "The Sleeping Pirate", or "Food Find". They bring out the necessity of silence and camouflage in separate ways.

With imagination a game or a series of games can be created without material aids, e.g. role playing.

Remember, games are games and not a classroom lesson. (see fig. 1)

Who Am I ?

Objective: To gain insight into the characteristics of a particular natural aspect or thing.

Place: Anywhere

Group size: The whole class or group

Activity: Ask each participant to identify himself/herself with any one object of nature. This should preferably be something seen near-by like leaf, earth, flower, sun, cloud, water, river, air, bird, tree, eagle, etc.

Let each participant state why he/she chose the particular object. Some may choose the same object, but let them all give their reasons. For all we know the reasons may not be the same e.g. a flower may be chosen for its colour, smell or beauty. (see fig. 2)

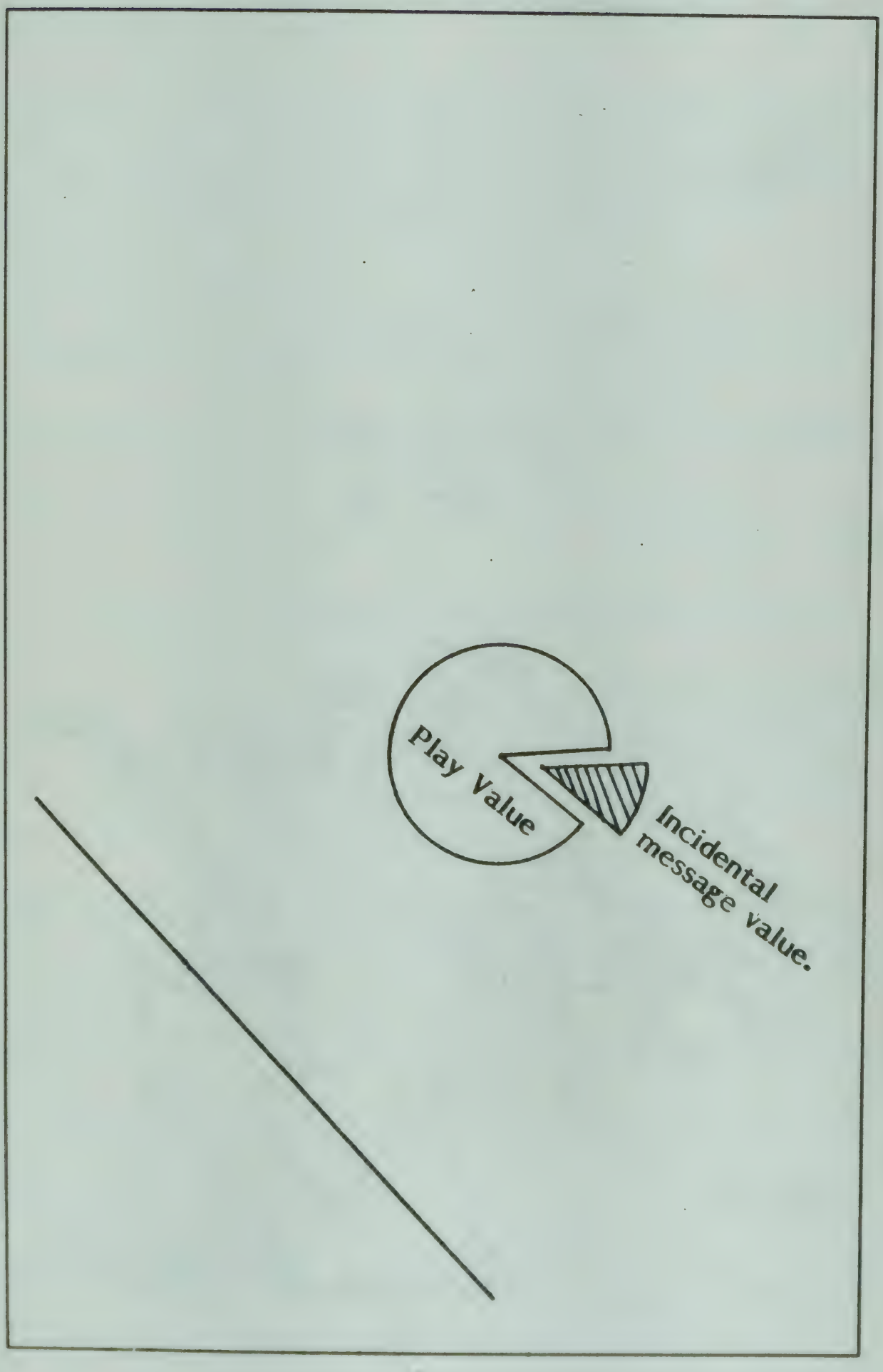
Older participants sometimes need to be assured that this game is not a psychological test and that marks will neither be given nor deducted for their choice or statements. Also ensure that each participant is allowed to speak freely without being interrupted.

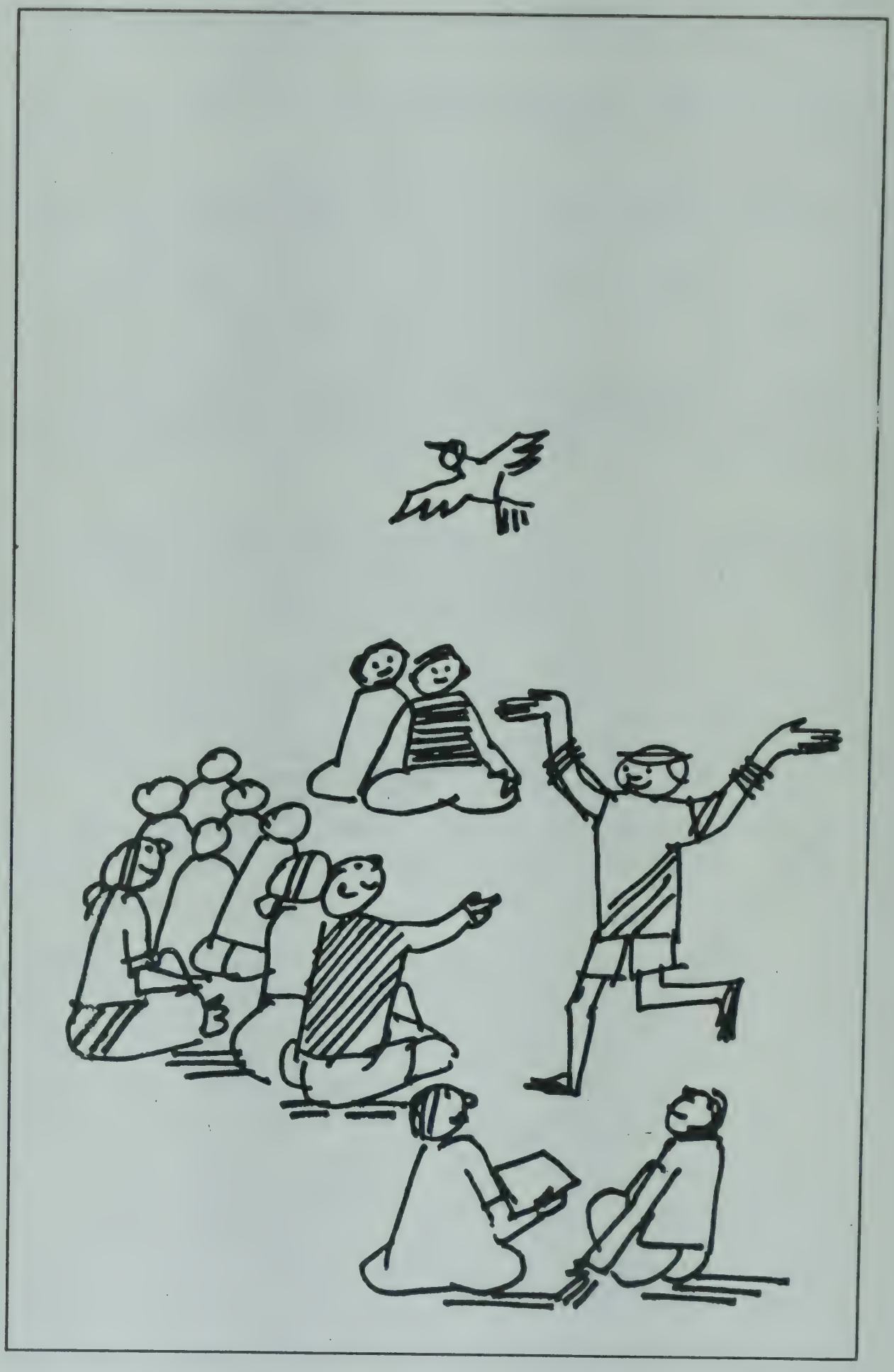
Tell the participants in advance that this game is not the end, but that it leads to the next activity, 'The Poet in the Child'.

Variations

a) This can be played as a team game. A relevant name tag is fixed on the back of each participant. Each name is one aspect of the nature project being done — e.g. in a project called 'Life on a Tree' use names like fruit, seed, flower, mango, neem, sparrow, spider, egg, nest, etc. The participant is not told what name tag he bears. A member of another team reads the name quietly.

The first participant asks relevant questions about his identity. The member of another team, who has read the name tag, answers only 'yes' or 'no'. The participant is allowed three guesses in, say, two minutes (the period may be varied according to age, knowledge etc.) Questions such as 'Am I living/non-living ? 'Do I live on a branch ?' 'Do I fly ?' 'Do I eat fruit/insects/suck nectar ?' etc. are allowed. Direct questions like 'Am I a branch ?' are not allowed.


Play Value
Incidental message value.



b) Instead of limiting the time, the number of questions may be limited — the first, second and third guesses to be made after five, ten and fifteen questions.

c) Instead of name tags on the back, the leader/teacher says, 'I spy with my little eye something beginning with the letter 'M''. It must be ensured that the thing is (1) visible (2) stationary and (3) relevant to the project. So if the tree is in fruit, the answer is ''mangoes'' — if that was what the leader/teacher had in mind.

The Poet in the Child

Objective: To encourage identification and characterisation of one natural object chosen by each student.

To encourage self expression in a controlled and precise manner while revising certain parts of the language.

Place: Anywhere

Group size: Any number

Preparation: Ask every student to keep a note-book ready or give each a separate sheet of paper.

Activity: Let each student choose an object in nature (like sun, soil, air, cloud, tree, grass, butterfly, sparrow, tiger, water, river, fish, etc.) which reflects his own personality or qualities. Students may then be asked to speak on how the chosen object reflects their personality.

Let them then take paper and pencil and:

1. write the name of the object (subject/noun) in one word;
2. write a second line of two words describing the qualities of the object (adjectives);
3. write a third line of three words of action about the object (verbs);
4. in the fourth line write four words describing how they feel about the object (phrase, sentence, expression); and
5. in the fifth and last line write a word which can substitute the first word (synonym)

Now let them read it like a poem. Here is an example

Butterfly
Delicate, graceful
Flutters, finds, sips
Seems weak but isn't
Beauty

Web of Life

Objective: To inter-relate the various aspects of nature using a single string.

To visually communicate the concept of the "Web of Life".

Place: Preferably outdoors. This game can be demonstrated in a hall or a stage.

Group size: For the string version, 12-40. For the ball variation, 8-20.

Preparation: Prepare name tags for each player either according to the object selected by him or from the list that follows. Keep a ball of string (about 350 metres) and six balls ready.

Activity: This game may preferably be played after the students have completed "Who Am I" and "The Poet in the Child". The whole group sits in a circle. Each student identifies himself with one aspect of nature e.g. rock, sun, soil, air, water, grass, tree, leaf, flower, bird, cow, butterfly, etc. (See list of names for this game).

Distribute the name tags. Each student wears a tag so that everyone can see it. Make sure that the four main elements of nature — sun, soil, air and water — figure on the tags.

Take the ball of string and give it to Sun. It is appropriate to begin with the Sun because all life is made possible by it. Let the Sun wind one end of the string on a finger and throw the ball to any aspect of nature he feels related to, e.g. Tree. The Tree then winds the string once or twice around his finger and after ensuring that it is not loose between the Sun and him, passes it to another aspect he feels related to, e.g. Fruit. Then Fruit offers the ball to Parrot and the line of relationships continues as the string is unwound from the ball and begins to form a pattern which the students hold together. The ball of string is thus completely used.

Let the students notice the web-like pattern formed by the string. Then ask them to raise the whole web chest high. Let them hold the web tight so that it remains taut even when pressed down. The students are asked to notice this.

Ask the students what would happen if some of these aspects did not exist. Let the students representing those aspects drop the string. Notice the visual effect. More aspects may be dropped to dramatise the effect. Now press the web down. It would probably touch the ground, because it is loose.

Ask the students what would happen, if the Sun or any of the three other major elements of nature did not exist. Conclude the game with the students understanding how inter-relationships exist and why they are important.

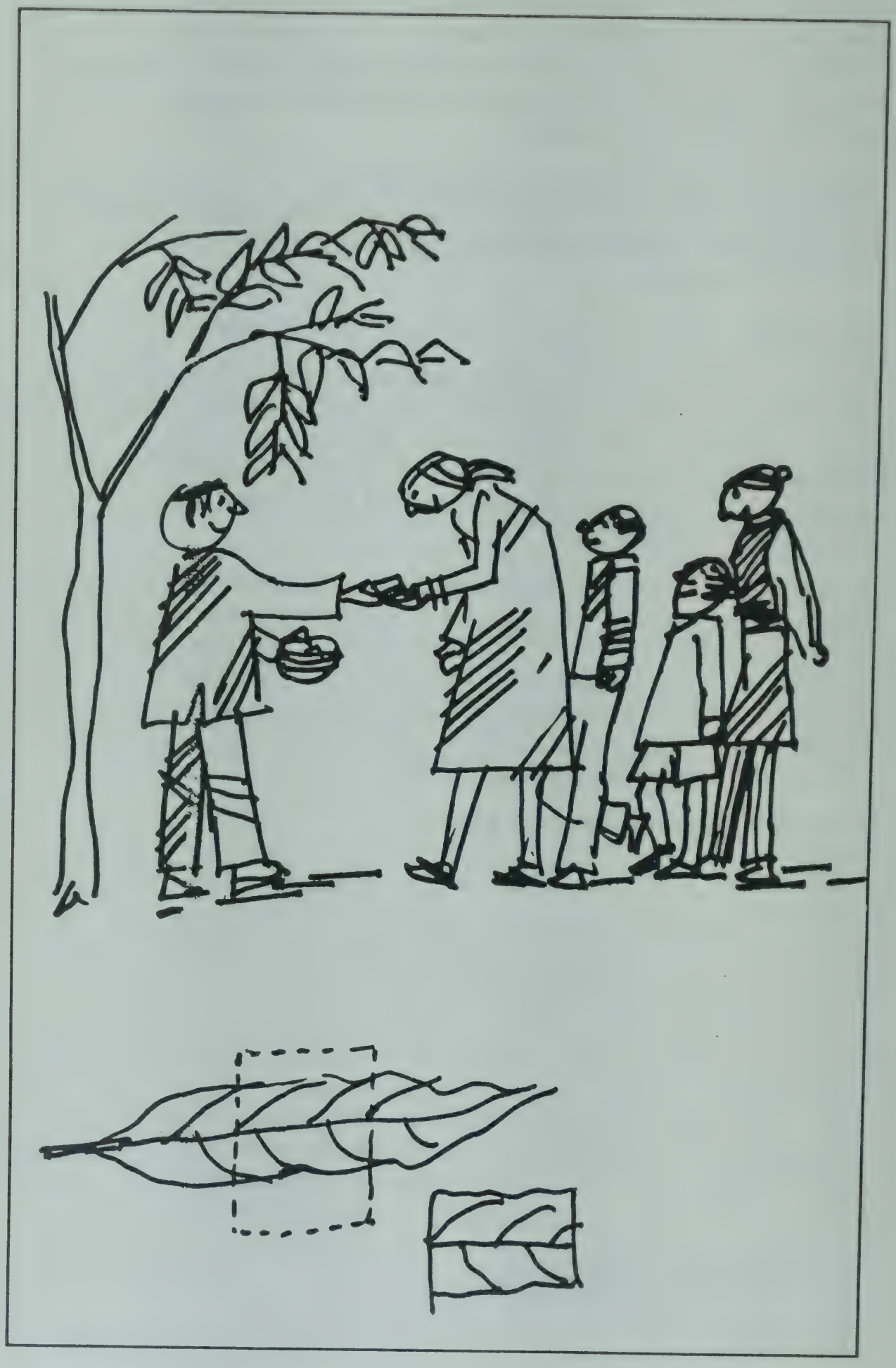
Variation

Instead of a ball of string one could use three or more, preferably six, rubber balls to play this game. Have the students identify their links, e.g. the Sun to Leaf to Flower to Butterfly to Frog etc. Give one ball to the Sun to pass to the next link e.g. Tree which in turn, passes it to Leaf etc. Each student must know from where the ball comes and where it goes.

In the next round when the first ball reaches the third or fourth link give another ball to be passed and so on with the third, fourth, fifth and sixth balls. It is very difficult to get a perfect flow going in this game. After a few rounds of confusion you may mention how nature functions without the links being broken, so that every aspect is sustained. What would happen if in nature, there is confusion or a lapse or delay in sustaining the next link ?

List of Names for Web of Life

1. Sun
2. Air
3. Water
4. Soil
5. Tree
6. Fruit
7. Parrot
8. Algae
9. Fish
10. Eagle
11. Turtle
12. Insect
13. Frog
14. Mosquito
15. Lizard
16. Leaf
24. Humus
25. Shrub
26. Seed
27. Fungus
28. Snail
29. Monkey
30. Spider
31. Snake
32. Mongoose
33. Kingfisher
34. Washerman
35. Woodcutter
36. Buffalo
37. Honey
38. Honey bee
39. Squirrel



17. Flower
18. Butterfly
19. Ant
20. Student
21. Grass
22. Dead leaf
23. Earthworm
40. Moss
41. Grasshopper
42. Plastic bag
43. Dead wood
44. Paper
45. Crocodile

Get Me My Leaf

Objective: To familiarise oneself with nature.

Place: Any place with trees and plants.

Group size: 20

Activity: A leader is selected. He collects a few dry leaves and tears them into small pieces. After this, he gives a piece to each student.

When he says 'go' each student has to go and find a whole dry leaf similar to the one from which his piece has come. The first student who finds a matching leaf is the winner of the game. (see fig. 3)

Hide and Seek

Objective: To make the participants "see" instead of "look".

Place: Anywhere, preferably outdoors.

Group size: Any number

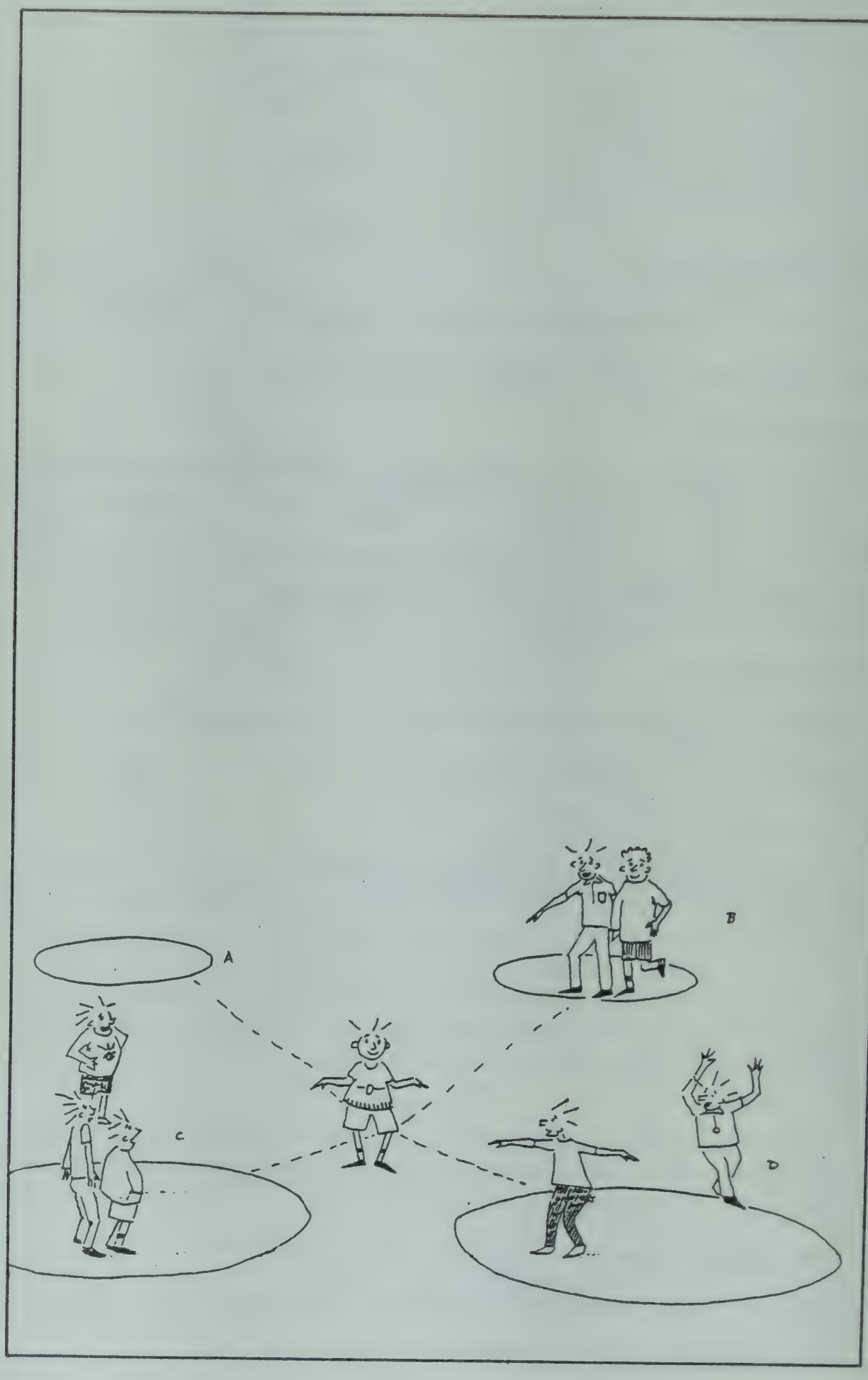
Activity: Collect without destroying or disturbing 30 or more natural or man-made objects. These should be kept on a trail 100 metres long (or in a class room) in such a way that they are not easily seen even when one is looking at them. Ask each person to take a walk along the trail and locate them without pointing at, touching or lifting them. Each participant should make a list of the names and locations of the items he has seen. They may be sent back to look for more items.

Do ensure that there is a short interval of time between two students sent. On the other hand, this could also be played as a team game with say 5-10 members in each team.

'Ten Seeds Game'

Objective: To get to know more about plants and trees.

Place: Any place where plants and trees grow.


A
B
C
D

Group size: Any number.

Activity:

- The group chooses a leader.
- The leader draws a Winners Circle.
- Then the leader says 'Ready' and the group stands in a line to start.
- The leader says, 'Go and collect ten different seeds. Collect seeds which you recognize.'
- The first person who comes with ten seeds is the winner and he puts his seeds in the circle.
- Several turns would make a collection of seeds in the circle.

'Where do we go ?'

Objective: To introduce students to the concept of Environmental Destruction.

Place: Open ground

Group size: Any number.

Activity: The Hurdleman tries to stop people from reaching their chosen destination. He makes four groups of students stand in four circles. Within the circle the player is safe. Once the groups are accommodated in the circles which may be named A, B, C, D, he makes a surprise announcement.

Sample Announcement:

In Circle A & C trees are cut and everything is dry. In circle B & D the fruit trees are loaded with fruits.

Now Go., (He can make a rhyme)

Children have to reach B & D. Those who are caught on way by the hurdleman are out. (see fig. 4)

The Hurdleman then changes his announcement.

Sample Announcement:

Now in circle B & D water is dirty and people get sick. A & C have pure water. Now go.

	Round I		Round II		Round III		Round IV		Total	
	FLOCK A	FLOCK B	F A	F B	F A	F B	F A	F B	F A	F B
Red Insects										
Brown Insects										
Green Insects										
Blue Insects										
Yellow Insects										
No. of birds alive										

Those who are caught on the way are out.

Winner is the one who is the last one to be caught.

The Sleeping Pirate

Objective: To use the sense of hearing as the primary means of perception and enhance it.

Place: Outdoors

Group size: Any number

Activity: One student is asked to play the role of a pirate guarding a treasure kept near his feet. Others who wish to possess that treasure are at least 50 metres away from the pirate. They may approach the treasure from any side.

The pirate is not allowed to guard the treasure with eyes open all the time. He takes a nap every now and then. Others can move only when the pirate is 'asleep'. However, if the pirate hears anyone approaching, he claps and gets up where upon everyone must freeze or remain motionless. He must then point out the person whose sound he heard. He may be asked to describe the sound. Anyone moving when the pirate is awake is out if the pirate catches him doing so.

Food Find

Objective: To show how camouflage is important in the natural order of things.

Place: Outdoors, preferably a grassy patch, field or any place which offers some camouflage for coloured match-sticks.

Group size: 10-20

Preparation: Make available to each player at least 20 matchsticks or tooth picks. So if 10 players are involved, 200 sticks will be needed. These 200 sticks will be in five different colours, such as green, yellow, red, blue and brown. They will have to be painted in these colours.

Keep a record of the number of sticks in each colour. Also draw a table to record the activity (see table sample attached).

Mark out a playing area the size of a volleyball court or the 'D' of a football field or about 10 × 10 square metres.

Activity: The players will stand 6 m away from the playing area. Ask

a volunteer to sprinkle the sticks over the area. Meanwhile explain the game to the players who are divided into two teams. The briefing would be:

"Today, we are about to play a simple game. To play this we must imagine we are birds. The playing area is a feeding ground. But unlike real birds we shall not eat insects. We will feed on these sticks, which are scattered on the field. They are in different colours (show one sample of each). The scattered sticks represent one insect each. The first team will be sent out to collect these insects. Each will have only one minute (or vary time suitably) in which to collect five insects only. Then the second team will do similarly. There will be four rounds for each team, if any individual is unable to collect five insects in a round he will be out of the game for the succeeding rounds."

Send the first group out and time them. When they return, count each members' collection. Note these on the table. Send out the next team and repeat the process through the four rounds.

After completing the table for each team and round, ask these questions —

1. Sticks of which colour were picked up in the greatest number during the first round ? Why ?
2. Sticks of which colour were picked up in the least number during the first round ? Why ?
3. After studying the table say how many insects of each colour still remain on the field.
4. How is this game similar to the processes in the living world ?
5. How is this game different from the processes in the living world ?
6. In what ways is colour important in the natural world ?

	Round I		Round II		Round III	
	F 'A'	F 'B'	F 'A'	F 'B'	F 'A'	F 'B'
Red Insects						
Brown Insects						
Green Insects						
Blue Insects						
Yellow insects						

	Round IV		Total	
	F 'A'	F 'B'	F 'A'	F 'B'
Red Insects				
Brown Insects				
Green Insects				
Blue Insects				
Yellow Insects				
No. of birds alive				

Food Chain Game

Objective: To communicate the concept of predator and prey.

To realise the aspect of time stress in feeding.

To highlight the situation in which the predator is also the prey for another species.

Place: Outdoors

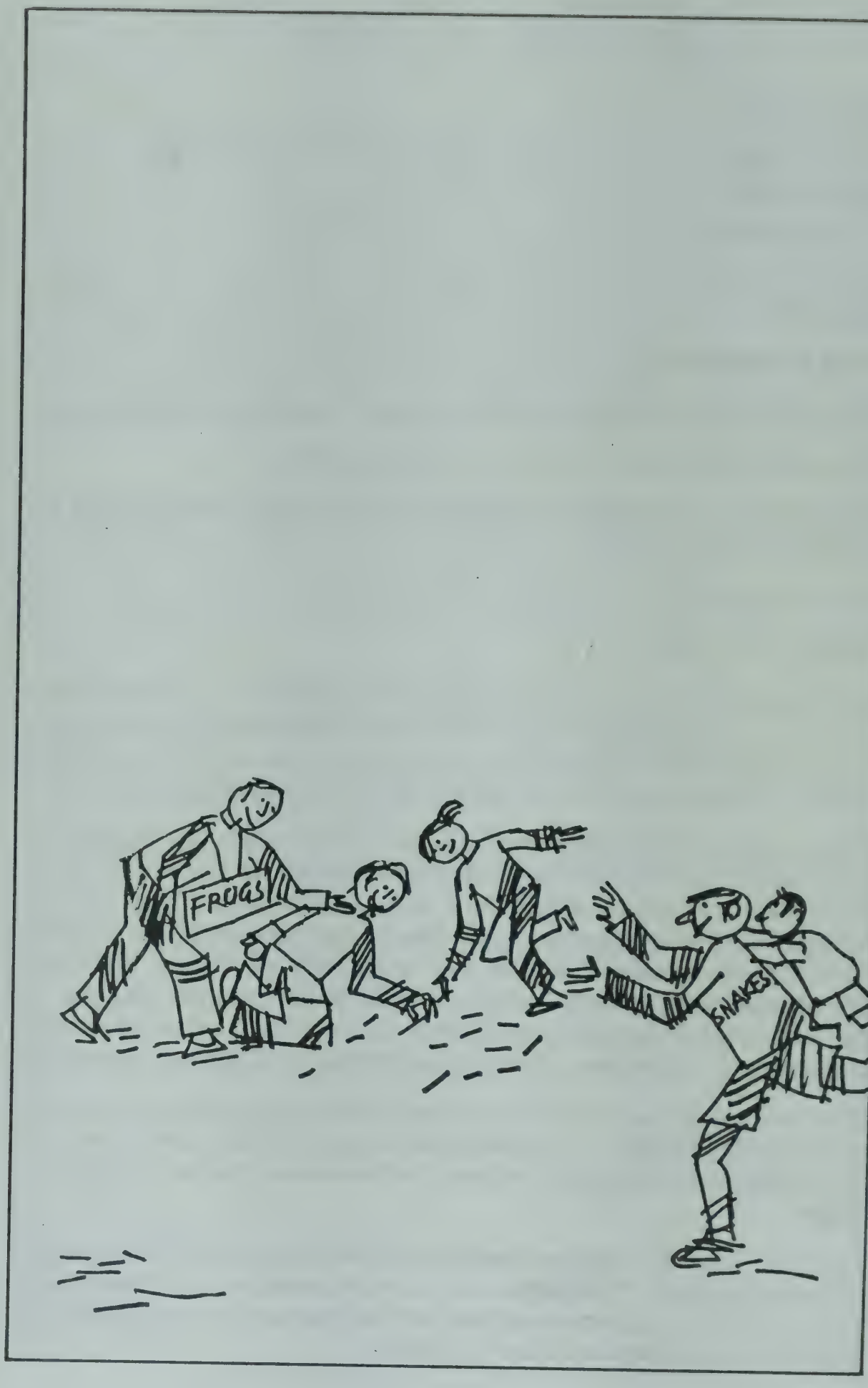
Group size: 12-40.

Activity: Make two teams of at least 10 members each. Each team is grouped behind a line 50 metres from each other. In the centre is a feeding circle of about 5 metres square. In this circle spread a boxful of matches (about 50 which gives 5 matches per member).

Students of one team are the Frogs and of the other the Snakes. At the first whistle or call the Frogs come to feed on the sticks. Each must collect as many bits of food as possible. After 15 seconds or so (you can decide your own time delay) give the second call or whistle which releases the Snakes to hunt their food, viz. Frogs. The Frogs try to escape back to the safety of their home. Anyone caught on the way is out. Frogs having less than three bits of food die of hunger and are out. Snakes who have not caught any Frog are out. (see fig. 5)

Continue the game for one more round. Now form a third team, consisting of the Eagles, of those who have got out. Start the game with the Frogs feeding. Quickly release the Snakes and subsequently the Eagles.

You may vary the intervals between calls to introduce the concept of stress or safety. The Eagles add a new dimension as to how nature functions in a multi-dimensional way. Introduce Hunters to kill the Eagles if more members are available.


FROGS
SNAKES

Make Your Own Games

Making of games is a social need. Children are good at making their own games. Therefore the leader of a play group must always catalyse their process of making new games. If a message could be interwoven in the game the innovation of a new game becomes a very rewarding activity.

What sort of elements can go in a game ?

Making a game cannot be a mechanical process. It needs some spark of an idea. Yet if we follow a certain broad process there is a possibility of getting that "spark". Children get game ideas very quickly, perhaps because the need for creating games is uppermost in them.

Here are some points which may be of use while constructing an Educational Game with a message.

- A game can have one message only. It can be very broad.
- The message should be interwoven with mental and physical activities.
- Action and movement are essential. Children do not like very static games.
- A game should provide surprise situations.
- A game should have elements of rewards and disincentives.
- Tense situations make a game involvement-oriented.
- Language element if skilfully used gives the message in a "casual" way.
- Games and rules go together. Let the group get accustomed to framing and accepting rules.

Sources of Environmental Games

Children themselves are the best source of new games. They always come out with new ideas if catalysed.

Yet the following can be some other sources for ideas.

1. Traditional games
2. Games played by organized groups.
3. Children's magazines occasionally come out with new game ideas.
4. Perceptual experience may form a good basis for games.
5. Mimicking and role playing offer a good scope for creating games.


SUNDAY MAGAZINE
finding new pastures
In the league of big hotels
Gulf faces recession
China's phenomenal progress

What's in the News?

K. Shivram

Monitoring newspapers, compiling news bulletins, news reading, producing newsletters and contributing to the columns of the popular press are interesting activities that school children can take up. Apart from encouraging the habit of reading newspapers regularly, these activities will help develop the writing skills of children. Variations and extensions of the activities may be tried in which news bulletins of AIR and Doordarshan may be monitored. In villages where newspapers are not received regularly, even old newspapers may be used for these activities. Here are some suggestions on organising these in your school:

Spot the News:

Ask each student to read one newspaper carefully every day and mark (with a pen or pencil) every environment-related report, feature, article, picture or advertisement appearing in it. You will have to explain to them what the scope of the term environment is (some points that you may refer to are listed at the end of this note). When their parents and others in the house have finished reading the paper, let the student take out clippings of all these items and paste them on a sheet (or sheets) the size of a standard newspaper page. (Old newspapers may be used for this too). The items may be arranged either chronologically or according to the subjects covered.

In making the paste-up page, the students may be encouraged to follow the lay-out of the newspaper they regularly read. The paste-up page may be given a name (like "ABC School Environment Bulletin/News" etc.) and displayed on the school notice board.

Here is the News:

Based on the "Spot News" activity, a student may be asked to prepare a weekly news bulletin which he/she may read out at the general assembly, say, on Monday morning. This may be done by rotation so that every student in your class gets a chance to read a news bulletin.

Depending on the age group, the bulletin may be put together in one of three ways: (a) Just listing all the headlines (if they say enough) subjectwise or in chronological order; (b) Listing the headlines and

first sentence/para of each item; and, (c) Giving summaries of each item arranged according to importance.

Share the News:

As a follow-up to the first two activities, the students may be encouraged to produce an Environment Digest of their own. Different students would be going through different newspapers and in different languages. Form an editorial group of say five to ten students and let this group meet once a month and scrutinise all the paste-up pages made as part of the "Spot the News" activity and the news bulletins made for the "Here is the News" activity. In addition, the group can invite contributions in the form of articles, illustrations, cartoons, photos, features and news items from all students in the class. Selecting the best of all the material received, the group can bring out a Newsletter. This may be handwritten, typed and cyclostyled/photocopied, or printed depending on the facilities/resources available. It may be a quarterly, half-yearly or annual publication, and may be given an appropriate name which includes the name of the school (ABC School Environmental Quarterly/Annual etc.).

When many schools in the network take up this activity, the publications may be exchanged between the institutions. Since each publication will also carry reports/features/articles on activities of a particular school and local happenings, such exchange will lead to a sharing of useful and interesting information.

Dear Editor.....:

As an extension of the three activities described earlier, the students may be encouraged to write to the newspapers they read. They can make a beginning with letters to the editor. While reading the environment-related stories let them try to spot any errors in them. (This will make them read the stories carefully). Whenever they spot an error, let them write to the editor pointing this out, and giving the correction. Such letters are most likely to be published. Students must be asked to read the "letters" and write the same format. Once a letter is published, the student will be thrilled and will pursue the activity. They can then be encouraged to diversify their writing. Letters can deal with fascinating facts/incidents about which one is reminded while reading a report or article; they may also furnish information or offer comment.

Power of the Press:

Once the children cultivate the habit of reading newspapers and

writing to them, they can be encouraged to write short reports on activities of their school (Environment Day function, etc.) and happenings in their neighbourhood, as also descriptive features on specific events/issues on which they have first-hand information. They can also be encouraged to send in illustrations, cartoons, poems, photographs etc. which may be of interest. Most periodicals and magazine sections of dailies allot some space for contributions from children. If some of these get published in the mass circulated dailies, they will see how certain problems get solved much sooner than expected. (A long neglected garbage pile may get cleared overnight if a photograph of it appears on the front page of a local newspaper). The students will then realise the power of the press which, as good citizens, they can harness for the public good.

Competitions, Prizes:

To encourage students to put in their best efforts, competitions may be organised in some of these activities. Classes may be divided into different groups and prizes awarded for the best bulletin, newsletter etc. from among those produced by different groups. Similarly prizes may be awarded for the best three contributions of students published in the popular press.

What "Environment" means to us

The term "environment" means different things to different people. Before asking children to mark environment-related items in newspapers, we must, therefore, clarify that we refer to the environment in its widest sense — including the physical (both natural and man-made), social and cultural environment.

Here we list the broad heads under which environment stories carried by newspapers may be classified. The list is, of course, not exhaustive and only gives a rough idea of the term 'environment'.

Land

Soil erosion, soil salinity, water logging, loss of soil fertility due to wrong agricultural practices, soil mismanagement, problems of irrigation, desertification.

Water

Water pollution, river pollution pollution control and government waste-water treatment.

Forests

Problem of overgrazing, deforestation, firewood shortage, people's movements, encroachment on forests, consequences of deforestation, social forestry programmes.

Dams

Irrigation, electricity generation, flood control, destruction of habitat, dams and diseases, destruction of ecosystems, dams and earthquakes, displacement of people by dams.

Atmosphere

Air pollution, thermal power stations, fertilizer factories, textile mills, traffic, state of air pollution in major cities, pollution control law, plants and air pollution, noise pollution, climate and carbon dioxide.

Habitat

Urban problems, housing and slums, water supply, sanitation, urban transport, road safety. Rural habitat, rural housing, rural water supply, rural sanitation, government plans.

People

Indigenous technology, nomadic people, mechanisation and unemployment, tribals, industrialisation, refugee settlements.

Health

Health and poverty, water-borne diseases, sanitation, malnutrition, malaria, pesticides and diseases, smoking and cancer.

Energy

Non-commercial sources, energy problem in rural areas, firewood problem, alternative sources of energy, bio-gas, solar energy.

Wildlife

Impact of people on wildlife and ecology, endangered animals, conservation projects, trade in wild animals, activities of sanctuaries, conservation movement, wildlife bodies.

Official Policy

Governmental research studies, environmental impact assessment, eco-development programmes, environmental information, activities of the Department of Environment, Forests and Wildlife, legislation.

With Live Animals

Lavkumar Khachar

Perhaps the most dramatic and unforgettable method of teaching children bio-sciences is to use live animals. Before we discuss any examples, it is essential to caution that when using animals, it is absolutely necessary that animals are very carefully handled and are not subjected to any form of stress. Children should be first told that animals are living things like themselves and can get hurt, and that it is cruel to cause any discomfort to them, howsoever slight it might be. The teacher should be confident that the animals being used in a teaching situation are used to being handled and are not likely to get disturbed by a group of children. This is particularly important for the larger animals. Care needs also to be taken to see that children do not get bitten or scratched. Apart from this certain dangerous diseases are also transmitted by animals to people. Animals must be at ease if their normal functions are to be observed, for under stress they may behave abnormally.

An aquarium full of fish is a very attractive facility, and a number of interesting concepts can be taught to the children, as, for example, the inter-relationship of plants and animals. After telling the children that fish take in oxygen from the water instead of from the air, the teacher should ask, "Since the amount of water in the aquarium is limited, how do the fish continue getting oxygen ?" The children will of course say that the gas enters the water from the air touching the surface. The teacher can seal off this source by spreading a thin layer of oil on the surface of the water. It will be observed that the fish will not feel unhappy even after a long time in an aquarium with green plants, while in an aquarium not having green plants, they will come gasping to the surface. The concept can then be enlarged to make them appreciate that the carbon-dioxide we breathe out is removed similarly from the air by the plants around us.

Another very important concept can be graphically illustrated by using three aquaria, one having plants and fish, one with clean water and plants and the other with dirty water and plants. The aquaria should be allowed to remain near an open window for several days. It will be seen that there will be mosquito larvae in the two aquaria without fish. Discussions which follow will bring out the fact that the fish have eaten up any larvae in their aquaria while there being

no fish in the other two, the larvae can live without any fear of being eaten up. Further discussion can lead to the fact that where there is a lot of clear water with plenty of fishlife, there will be no mosquito menace, while wherever there are collections of stagnant water even in very dry areas, mosquitoes will multiply. Why mosquito larvae can thrive in dirty water and fish cannot can be further understood by the fact that the plants would die in dirty water as fish would too, while the larvae are able to live in it because, by observation, the children will learn that the larvae come to the surface every now and then. That they must be breathing from the surface can be proved by spreading a film of oil over the water; the larvae will soon die.

Terraria, like aquaria are very easy to set up. They are in fact aquaria but do not have any water in them; sand, rocks and land plants can be planted and the animals to be studied can be put into them. Some of the best animals for observation in a terrarium are the small reptiles like the garden lizard and the house gecko. Both these are insectivorous and are best kept during the rainy season. Scorpions, insects like grasshoppers, praying mantis and cockroaches are all useful and a lot can be learnt about insects and their allies by observing them in carefully maintained surroundings. Of course, the scorpion is not an insect and the difference between scorpions and say a cockroach, can be understood by observing live specimens.

Before taking any animal into the classroom, particularly if it is required to be kept for a number of days, the teacher should research on the creature's basic requirements and be sure to provide these. During the rainy season, most butterflies and moths lay eggs and by carefully examining monsoon plant growth, eggs can be located. These can be placed in a terrarium and children can make observations on the hatching and subsequent behaviour of the larvae until they pupate and finally emerge as winged adults. It must be remembered that butterfly and moth caterpillars are very specific in their selection of food plants and the rule of the thumb is to give them fresh leaves of the type of plant on which the eggs or caterpillars were found.

Larger animals can also be brought into the classroom, but they are difficult to keep in confinement. Snakes are a very fascinating group of animals for arousing the curiosity of the children, but it is always best to remember that handling snakes has to be done with great care and it is likely that if children overcome their fear of snakes, they might start handling venomous species and chances of getting

bitten cannot be ruled out. Domestic animals are of course the best and it is surprising why they have not been used more in getting children to recognise the various differences betwen major Classes of animals and between their major Families. Pets are very easy to keep and entire sets of observations can be developed around them. Some of the obvious concepts would be understanding the basis of classification of say Carnivores, Rodents and Ruminants. Further observations can be made to show how the Canidae (Dog Family) differs from the Felidae (Cat Family) and so on and so forth.

The processes of evolution can be explained by observing the varieties of domestic pigeons and comparing them with the wild species from which they were developed by man. It would, however, have to be explained that natural selection is here replaced by human selection. All types of domestic animals can be best used for this concept. Specialisation of body parts to suit the various life needs of animals can also be a theme which a teacher can introduce with the help of live animals.

It is of course not possible to bring very large animals into the classroom, but children can learn about lions and tigers by first observing a domestic cat and then being taken to a nearby zoo and shown the bigger cats. A zoo visit can open up a wide opportunity for study of the animal kingdom, particularly the mammals and birds. Today it is surprising how few people know the difference between and the similarity to be found in the various groups of ruminants, such as the domestic ones like the cow, buffalo and camel and their wild relatives the deer, antelope and gazelle. The innovative capacity of the teacher will be the only limit to how much can be taught by bringing live animals into the educational experience of the children.

Six Principles of Interpretation

Anil Patel

---

1. Interpretation should relate what is being displayed or described to something within the personality of the visitor, his experience and his ideals.
2. Interpretation and information are not the same. Interpretation includes information and is revelation based on information.
3. Interpretation is a combination of many arts and is teachable.
4. The aim of interpretation should be to provoke and not to instruct.
5. Interpretation should aim at presenting a whole picture rather than a part of it.
6. Interpretation addressed to children should not be a dilution of the presentation to adults, but should follow a fundamentally different approach.

Basic Assumptions

1. People learn better when they are actively involved in the learning process.
2. People learn better when they are using as many senses as appropriate. It is generally recognized that people retain about:

   10% of what they hear
   30% of what they read
   50% of what they see
   90% of what they do

3. Each person has unique and valid ways of processing information and experiences.
4. New learning is built on a foundation of previous knowledge.
5. People prefer to learn that which is of most value to them at the present moment.
6. That which people discover for themselves generates a special and vital excitement and satisfaction.
7. Learning requires activity on the part of the learner.

8. Friendly competition stimulates learning.
9. Knowing the usefulness of the knowledge being acquired makes learning more effective.
10. People learn best from first-hand experiences.
11. People learn best when an experience is close to them in time and space.
12. An organised presentation is more memorable than an unorganised one.
13. Increasing the ways in which the same thing can be perceived helps people derive meaning.
14. Questions can be effectively used to help visitors derive meaning.
15. Giving visitors expectations at the beginning of an interpretive activity will focus attention and thus improve learning.
16. Using a variety of approaches will enhance learning.
17. The ways in which interpreters respond to people will affect their learning.

Communication

1. Use simple language
2. Know your audience
3. Choose terms carefully
4. Keep the talk at an understandable level
5. Keep a moderate rate of speaking
6. Use humour where possible.
7. Humour should not be directed at any individual, community or religion.
8. Understand the difference between listening and hearing.
9. Don't overload the listener.
10. Put the listener in the perspective frame of mind.
11. Feed back is important.

Action Programmes

Vivek Khadpekar, Abdul Razak,
Poonam Kathuria, R. Suresh

The purpose of education is not merely to equip the student with the skills necessary for earning a livelihood, but also to create in him an awareness of and a sensitivity to social and environmental realities. Such awareness is essential if the student is to become a responsible citizen. One of the ways of achieving this goal is to involve students in socially relevant action projects in which learning and doing become mutually supportive. Such projects will implicitly take the student through a process of creating awareness, provoking questions, instilling conviction, and spurring action. "Action" in this context is seen as any activity which results in an outcome that is perceptible or tangible as a desired change.

Objectives

1. To explore and promote the role of school children as motivators/agents of change;

2. To develop the confidence of children in their own efficacy in such a role through small, manageable activities and projects;

3. To emphasize the practical aspects of learning as well as learning from practical experiences.

A student action project may be triggered off by any of the activities suggested in the other technical sessions. For example, the findings of a field trip or a newsgathering activity may give rise to the desire to bring about a certain kind of environmental change; the want of a particular item for the resource centre may lead to an inquiry into the reasons why that item is not easy to come by and what can be done to fulfill the want; an observation and measurement activity may lead to the realisation that a particular species of plant in the neighbourhood is not growing to the size it ought to, and an analysis of the causes of this may be followed by corrective action. Thus action projects could become a follow-up of a variety of other activities.

A few ideas for action projects are suggested below, which the teacher may try out initially within the organizational context of the school. Once the students have demonstrated their ability to carry out such activities and have gained confidence, they may be encouraged to try similar exercises outside the school context, in their

own homes or neighbourhoods. They will need to be guided as to the organizational implications of the changed contexts, and encouraged to evolve appropriate implementation structures for themselves. Such an experience could prove a valuable lesson in citizenship.

Project Ideas:

1. *Children and Trees:* Divide the class into groups of 3-4 children; assign them the task of planting and nurturing to a level of reasonably assured survival a lot of 10-12 trees in the school compound, on community land, by the roadside, or any other convenient location. The emphasis in this project is on the protection of trees, and the long-term goal the encouragement of attitudes conducive to the greening of the environment. This is why, rather than entrusting one tree to one child, a group of children should be assigned a cluster of trees. In the situation thus created, both the joy of success and the frustrations of failure are shared. A tree that is dying need not be the responsibility of a particular child, thereby removing the element of humiliation associated with "losing". Also the importance of teamwork and co-operation is emphasised. Such activities have been successfully carried out in different parts of the country as part of camping programmes, and have equally good potential in the school/neighbourhood context. In case a suitable plot for plantation is not readily available, each child could be asked to grow a number of saplings at home in polythene bags or cans filled with appropriate soil mixture. After it has grown to a level of assured survival, it may be transplanted onto a selected location.

A variation of this activity could include transplanting peepul trees from unwanted locations, such as crevices in building walls, to a suitable location on the ground. Another variation could be to facilitate regeneration on a plot of land. This should be done by asking the children to prevent the cattle from grazing and human beings from removing the vegetative cover for a period of time. Before commencing this activity it should be ascertained that there is root stock available on the selected plot.

2. *Preventing Water Stagnation:* Ask the students to identify small bodies of stagnant water in the school/neighbourhood which are seen as environmental nuisances, for example in a pothole or a cesspool in which mosquitoes breed. Care should be taken to ensure that these have no beneficial value for any section of the community. Now ask the students to devise methods of draining them (e.g. by making channels leading into a naturally drained area, making soak pits

etc.). Organise filling up of the cavities containing the stagnant wate and subsequent maintenance. Get the students to identify the sourc of the water which collected and devise ways of stopping the inflow An alternative which could be considered is to plant and grow tree around the damp ground which would remove the moisture by transpiration. This is commonly done in coastal areas by growing banana trees around places where water accumulates.

3. *Fodder Cultivation:* From the same acreage six times more cattle can be supported when stall-fed than when allowed to graze freely. Children can select two plots of land and from one cut grass to feed the cattle. On the other they can allow the cattle to graze freely. Let them observe the difference and devise ways of communicating their findings to the community. Since movement of cattle on land stimulates the growth of ground cover, the activities on the two plots may be rotated over a suitable time period. A variation of this activity could consist of fencing off a part of the village grazing for fodder cultivation.

4. *Garbage Management:* Take the class to the school's garba and ask them to identify and sort out the bio-degradable an non-degradable components. Let them further divide these recyclable and non-recyclable materials, and devise strategie the management/disposal of each. They can think of ways in w the maximum amount of material can be recycled, with minim of pollution. This could include ideas for use of the material in cr Ask them to think of similar strategies for t streets/neighbourhoods in which they live. Explain the role of t municipal authorities in managing the environment and ask them to think how this task can become better organised with more cooperation from citizens.

A variation of this activity could be to organise sorting of the garbage at the stage of generation itself into degradable/non-degradable, recyclable/non-recyclable etc. An extension could be the creation of compost pits for the recycling of "non-recyclable" degradable waste.

A related learning exercise could be to take students around different parts of the city to study the kinds of garbage generated and the different uses to which they are put.